APPENDIX

D-6

Aviation

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AVIATION

Summary Of Aviation Task Force Input to the 2004 Regional Transportation Plan

A. Introduction

In 1998, SCAG established a temporary Aviation Task Force consisting of elected stakeholders, airport managers and aviation industry representatives to develop a regional aviation strategy that could be evaluated and integrated into the Regional Transportation Plan (RTP). Although SCAG has no direct role in the development and expansion of airports, SCAG conducts regional aviation system planning and is required to look at aviation plan impacts on the surface transportation infrastructure, and to plan and program off-airport ground access improvements.

The task force's sunset provision was invoked in 2000 after recommending several aviation scenarios for consideration in the 2001 RTP. However, after the RTP was adopted, aviation plan implementation was not proceeding based on regional and nationwide factors, including:

- The impacts on aviation from the September 11, 2001 terrorist attacks
- The economic downturn
- Orange County's Measure "W" which passed in March 2002 eliminating El Toro as a commercial airport
- Physical and political problems with expanding Ontario Airport beyond existing physical capacity
- March Inland Port's intention to focus on air cargo rather than air service, although they have not specifically precluded passenger service over the long-term.

The Aviation Task Force reconvened in September 2002 in order to review and revise the 2001 Adopted Aviation Plan for the RTP. It was noted that the previous plan was adopted through regional consensus, showed tremendous potential and just needed revision in order to reflect current aviation conditions. SCAG was therefore directed to refine the plan to mitigate economic and political factors and to maximize the efficiencies of the plan to serve the greatest number of air passengers and air cargo within the constraints built into the plan.

B. New Aviation Plan Variations

Six new 2030 variations of the 2025 regional aviation plan adopted for the 2001 RTP were developed, and modeling results were presented to the Aviation Task

Force for their consideration. They ranged from *"all airports unconstrained"* on one end of the spectrum to *"all urbanized airports constrained to physical/legal capacity and several suburban airports constrained"* on the other end. All of the new plan variations eliminated El Toro from the regional system. Two variations are included in *the 2004 Draft Regional Transportation Plan* (RTP) and *Draft Program Environmental Impact Report* (EIR). These are the Constrained Variation and the Preferred Aviation Plan.

SCAG's demand forecasts are based on market behavior in that it assumes, given a certain set of circumstances, that an air traveler (or air cargo shipper) will choose one airport over another (or choose multiple airports for different flights). Detailed descriptions of the modeling process and assumptions used can be found in subsequent sections of the aviation technical appendix.

1. <u>Constrained Variation</u>

The **Constrained Plan Variation** establishes a constrained baseline to be used as a "no project" alternative for comparing aviation plan alternatives. It assumes that existing physical and capacity constraints at urban airports would remain in place.

Existing airports include Los Angeles International (LAX), Bob Hope (BUR), Long Beach (LGB), John Wayne (JWA), Ontario (ONT) and Palm Springs (PSP) airports.

New airports include Palmdale (PMD), San Bernardino International (SBD), March Inland Port (MAR), and Southern California Logistics (SCL) airports. It should be noted that Palmdale has accommodated limited commuter passenger service in the past, and San Bernardino and Southern California Logistics have both accommodated limited charter service for both passengers and cargo. MAP stands for million annual air passengers. Basic assumptions of the Constrained Variation include:

- LAX: Existing physical (runway) capacity of 78 MAP
- BUR: Existing physical (terminal gate) capacity of 9.4 MAP
- LGB: Existing flight restriction of 41 flights/day, or 3 MAP
- JWA: New Settlement Agreement constraint of 10.8 MAP
- ONT: Existing physical (runway) capacity of 30 MAP
- SBD and PMD: Cargo, charter corporate aviation, and commuter/short haul passenger service
- MAR and SCL: Cargo charter and corporate aviation only
- No MagLev system assumed
- Airport ground access improvements are assumed to be those currently planned
- Market incentives assumed (same package as 2001 plan)

Service limitations assumed at outlying/suburban airports are based on the premise that current financial plight of airlines would continue for some time, and that they would not have substantial resources to invest in new services at new or expanding airports.

Modeling of this alternative paid particular attention to passengers who would curtail their travel due to flight constraints, and passengers who would fly to large hub airports outside the region to catch long haul and international flights that would not be conveniently available at SCAG Region airports.

The Constrained Variation provides for about 140.8 million annual passengers (MAP) in 2030, which is 26 MAP less than what was forecast for 2025 in the 2001 Adopted Plan. Economically, this is significant. For every one million regional air travelers, there is a regional economic benefit of $620 million and 4,475 jobs. In its deliberations, the Aviation Task Force addressed the challenge of how to maximize air travel demand within the airport physical and policy constraints established by our elected officials.

2. Moderate Variations

Staff initially prepared a **Moderate Plan Variation** of the 2001 Adopted Plan in addition to the Constrained Variation. It was based on the same set of airports, but assumed a faster financial recovery of the airlines, and moderate expansions of several urban airports (LAX was maintained at 78 MAP). As the adopted plan assumed three runways at Ontario, that configuration was maintained. The plan also assumed:

- A full high speed rail (MagLev) system
- Several remote aircraft parking facilities at Bob Hope
- Continued legal constraints at John Wayne
- A new generation of larger but much quieter (stage 4) aircraft would use LGB by 2030 allowing more passengers to be served within the noise limits
- San Bernardino (SBD), March (MAR), Southern California Logistics (SCL) and Palmdale (PMD) unconstrained, with the full range of market incentive assumed in the 2001 plan.

Aviation demand under this variation was modeled at 154 MAP in 2030, thirteen MAP lower than the 2001 Adopted Plan's 2025 forecast.

There were several objections to this variation. City of Ontario representatives were unsure if the community would accept a third runway, because of potential environmental impacts. The City was willing to maximize efficiency within the existing physical capacity of the facility (now estimated at 30 MAP). In addition, March Inland Port was focusing on cargo only. However, it was noted that while the March airport authority was presently focusing on cargo, it did not want to "tie the hands" of future commissioners.

In response, staff refined the moderate variation, providing only two runways at Ontario Airport. This **Revised Moderate Variation** included greater coordination between Ontario International Airport and San Bernardino International Airport. A significant amount of commuter and short-haul demand was shifted from Ontario to San Bernardino. Passengers with long lag times between connecting flights could make connections between the airports via MagLev. While this variation increased regional demand to nearly 155 million, it was still 12 million short of what was forecast for the 2001 adopted plan.

3. Unconstrained Scenario

For comparative economic analysis in the 2004 RTP EIR, staff modeled an **Unconstrained Scenario** to determine what the unconstrained aviation demand would be for the region in 2030. It assumes that there were would be no airport capacity constraints whatsoever and if every airport could develop in an unconstrained fashion to meet demand. The unconstrained demand is forecast to reach 192 million passengers in 2030, nearly 37 million passengers more than the revised moderate variation. The economic impacts of being unable to support 37 million annual passengers are significant.

C. Preferred Aviation Plan

To minimize the potential for substantial economic loss to the region, staff developed the **Preferred Aviation Plan**, designed to maximize efficiencies inherent in a coordinated regional transportation system. Along with the Constrained Variation, the Aviation Task Force approved the Preferred Aviation Plan for inclusion in the Draft 2004 RTP.

Like the moderate variations, the Preferred Aviation Plan proposes moderate expansions at several urban airports, and faster financial recovery of airlines so that they could provide substantial new service at unconstrained suburban airports in the future. It also assumes an intra-regional high-speed rail system that would connect most of the airports.

The Preferred Aviation Plan embraces a number of unique features to help promote a decentralized aviation system. To maximize ground access efficiencies, seamless connectivity (and integrated pricing) between the MagLev system and airports is assumed. It also assumes integrated airport master planning, and the development of coordinated management strategies designed to "broker" airline service between airports. The plan also incorporates the recent "growth visioning" forecast strategy being developed by SCAG, that helps support a decentralized strategy. Modeling of the Preferred Aviation Plan indicated that it has the potential to serve 170 MAP by 2030, which would substantially minimize potential economic loss compared to the Unconstrained Scenario.

1. Basic Assumptions

Basic assumptions in the Preferred Aviation Plan include:

- LAX: Existing physical (runway) capacity of 78 MAP
- BUR: Three new remote terminal gates assumed, increasing its physical capacity to 10.7 MAP
- LGB: Larger aircraft with higher load factors assumed within the 41 flights/day airport restrict, increasing its capacity to 3.8 MAP
- JWA: New Settlement Agreement Constraint of 10.8 MAP
- ONT: Existing physical (runway) capacity of 30 MAP
- SBD, PMD, MAR and SCL: All unconstrained
- Full MagLev system assumed
- Airport ground access improvements from unconstrained list (i.e., recent submittals from local transportation commissions)
- Market incentives assumed (same package as 2001 plan)

2. Maglev

Efforts were made in the modeling of the Preferred Aviation Plan to boost Maglev air passenger ridership to suburban airports. It was determined that past modeling effort had been too conservative with regard to Maglev. New concepts were incorporated to increase ridership including:

- A “commuter multiplier effect” was assumed, which increased Maglev trip propensities for air passengers who use Maglev on a regular basis for other trip purposes, such as commuters with monthly MagLev passes.
- There would be “integrated pricing” that would combine MagLev fares with airfares in the total ticket price. International airfares out of suburban airports were assumed to be comparable to fares out of LAX.

3. Air Passenger Trip Propensities and Airport Preferences

For the Preferred Aviation Plan, the aviation demand model was re-calibrated to take into account new information that warrants adjustments to air passenger trip propensities and airport selection behavior, including:

- Increased generation of international demand was assumed, based on recent economic models that forecast increased shift of U.S. production facilities and corporate offices to Asia, and expanded integration of U.S. and Asian markets.

- Thresholds of passenger diversion to other regions such as the Bay Area were elevated, assuming increased delays at airports in those regions in the future.
- Passenger propensities to use satellite/suburban airports as opposed to LAX were increased, reflecting recent trends.

4. <u>Requirements for Long-Haul and International Service</u>

A major impediment in allocating substantial demand to suburban airports through the modeling process has been the ability to allocate long haul and international service, both of which have "multiplier" effects in attracting commuter and short-haul flights. Typically, an airport first needs to establish a substantial base commuter, short haul and medium haul demand in order to support long haul and international flights. These flights use larger aircraft that are expensive to operate and maintain, and airlines rely upon commuter and short haul service for connecting passengers to fill them up in a "hub-and-spoke" arrangement. Recent trends argue for adjustments to these assumptions, which have been made in the new modeling work:

- Future mid-sized long haul and international aircraft (such as the Boeing 7E7 currently under development) will be much more efficient than existing aircraft in operating in a point-to-point mode.
- There will be more code sharing between airlines in the future. For example, through code sharing an airline flying to London could book their passengers through to a variety of European destinations on various European airlines.
- Long haul and international passenger service will be operated in a more point-to-point fashion, primarily serving local demand, and relying much less on commuter and short-haul service to fill up flights.

5. <u>Facility Costs and Financing</u>

It is also expensive for both airlines and airports to provide facilities to accommodate long haul and international passengers. Those passengers consider their flights to be very important and arrive earlier at the airport. Larger terminal facilities with more amenities are therefore required to accommodate those passengers. For international passengers, customs and immigration facilities are also required. To reduce the costs for start-up long haul and international service at suburban airports, the new modeling assumes that:

- Airlines would cooperate to share staff and facilities, to spread costs among themselves. For example, airlines could share check-in staff at common use terminal counters, as well as baggage handlers.
- Start-up carriers would be offered attractive financial packages for initial service, including low landing fees and leasing rates.
- New financing arrangements would be developed to help subsidize the construction of new facilities needed to accommodate long haul and international service at suburban airports. Airline service marketing

programs, as well as free or low cost parking and shuttle service to MagLev stations for passengers, would also be substantially subsidized.

6. Airline “Brokering”

Cooperation between airlines discussed above would be “brokered” by airports. Besides attractive financial packages, inducements for airlines could include:

- Construction of common use/shared facilities
- Flexible lease and operating agreements

Close coordination between airlines and airports in a service “brokering” arrangement is also assumed to accomplish the following objective:

- Full information provided to air passengers about airport and service alternatives on airline and travel agent web sites and reservation systems. For example, if an international flight with the desired time, destination and price is not available at LAX, an air passenger or travel agent would automatically be directed to available flights at Ontario Airport or Palmdale.

7. Airport Cooperation and Integration

Airline brokering between airports would be accomplished through the integration of airport master plans, and the development of memoranda of understanding and contractual agreements between airports. These agreements would also identify complementary roles and market niches between airports, to increase synergy in the system and maximize utilization of available airport capacities in the region. Los Angeles World Airports (LAWA) would play a key role in integrating master plans for LAX, Ontario and Palmdale airports. Eventually, an airport “consortium” would be developed through memoranda of understanding between all of the airports in the regional system. The agreements would establish a common framework for coordinating all airport master planning and facility construction consistent with an adopted Regional Aviation Plan. The exact mechanisms for developing the agreements would be carried out by a proposed Implementation Plan that is outlined below.

C. Proposed Implementation Plan

Once an aviation plan is adopted for the 2004 RTP, a plan of action to ensure its future implementation would be prepared. The implementation plan would consist of the following elements:

1. Regional Airport Ground Access Improvement Plan

The Regional Airport Ground Access Improvement Plan would assess, recommend and prioritize needed ground access improvements for the adopted plan. Elements of the plan would include highway and arterial improvement, intersection improvements, light and heavy rail extension and linkage to airports including high-speed rail, high-occupancy vehicle (HOV) extension and linkage to airports, bus service improvements, park-and-ride facilities, and remote terminals linked to airports by rail and HOV connections. Specific ground access modeling would be conducted to test the effectiveness of the various improvements, with the overall goal of relieving congested bottlenecks and facilitating the transport of passengers and cargo from areas with airport capacity shortfalls to airports with available capacities. A comprehensive ground access study of Ontario Airport is currently being initiated. After the Regional Ground Access Plan is completed, a separate category of projects in the Regional Transportation Improvement Program (RTIP) and the RTP would be created for airport-specific ground access projects, that would identify high-priority projects that should implemented in the near term.

2. Regional Airport Financial Plan

This plan would list all needed airport facility and ground access improvements to implement the adopted aviation and airport ground access plans, associated costs, and existing and potential revenue sources to defray the costs. Projects would be phased and prioritized over the 26-year planning horizon for funding. Existing airport master plans and capital improvement plans would be integrated into the Regional Airport Financial Plan to the extent feasible. New financial mechanisms, including the use of congestion and environmental impact pricing of airport services, will be explored. The costs and available resources for implementing the market incentives assumed in the modeling of the alternatives will also be addressed.

3. Regional Airport Management Plan

The regional airport management plan would propose new institutional, organizational and administrative arrangements and structures for carrying out the adopted plan. The management plan could include recommendations for better coordination and communication between local airport authorities to implement the regional aviation, airport ground access and financial plans. It is proposed that the management plan would set the stage for the development of a regional airport consortium. It is currently proposed that the consortium would evolve through the following action steps:
:

- LAWA will take on greater role in implementing the adopted Regional Aviation Plan.
- LAWA will develop an "Integrated Metropolitan Airport System Plan." This plan will detail how LAX, Ontario and Palmdale will work with each other

and other airports in the region (such as Southern California Logistics, San Bernardino International and March Inland Port) in efficiently meeting regional aviation demand as defined in the RTP Regional Aviation Plan.

- LAWA will provide needed financial support to Palmdale and Ontario airports to construct new facilities and establish long haul and international service through attractive pricing arrangements and other inducements.
- LAWA will broker cooperation from airlines to provide more robust flight portfolios at Palmdale and Ontario, including long haul and international service.
- Palmdale will become a limited International airport, making all of LAWA's commercial airports international airports.
- Agreements between LAWA and non-LAWA airports will be developed to promote further decentralization of the regional aviation system. Different roles and market niches for airports will be defined, so as to reduce competition and increase cooperation and coordination between airports, and maximum utilization of available airport capacities in the region.
- The agreements will establish a common framework for a regional "Airport Consortium" that will coordinate all airport master planning and facility construction consistent with an adopted Regional Aviation Plan.
- The Regional Airport Consortium will coordinate with the Maglev Joint Powers Authority to ensure seamless Maglev connections to airports, and increase air passenger ridership via Maglev through integrated fares and other market tools.

2030 Aviation System Passenger Demand (in Millions)
(All Variations)

	BUR	JWA	LAX	LGB	MAR	ONT	PSP	PMD	SBD	SCL	TOTAL
Constrained (No HSR)	9.6	10.8	78.0[1]	3.0	1.0	30.0[2]	2.9	2.2	2.5	0.8	140.8
[1]51.3% International [2]13.4% International											
Moderate (ONT 3 rwys)	10.6	10.8	78.0[1]	3.8	4.3	34.0[2]	2.9[3]	2.9	2.0	0.8	150.2
[1]51% International [2]11.7% International [3]1.5% International											
Revised Moderate (ONT 2 rwys)	10.7**	10.8	78.0	3.8	4.9	29.9	2.9	3.4	9.2	0.9	154.6
Preferred Aviation Plan	10.7**	10.8	78.0[1]	3.8	8.0*	30.0[2]	3.2[3]	12.8[4]	8.7	4.0	170.0
[1]50% International [2]17.3% International [3]6.25% International [4]14.1%International											
Preferred Aviation Plan (no HSR)	10.7**	10.8	78.0	3.8	5.0	28.8	3.2	7.2	5.7	1.8	155.0
Unconstrained											192.0

The March Joint Powers Authority's focus is on 1) increased military activity and 2) air cargo. SCAG forecasts assume commercial passenger service not yet contemplated by the March Joint Powers Authority. SCAG has a long standing policy to give priority to military and national defense needs

***** Forecasts for Bob Hope Airport assume higher passenger activity within the physical constraints of the airport than what is assumed by the airport staff***

2001 Adopted Plan (year 2025)	BUR	ELT	SNA	LAX	LGB	MAR	ONT	PSP	PMD	SBD	SCL	Total
	9.4	29.7	8.4	78.0	3.0	1.7	30.0	2.9	1.7	1.8	0.8	**167.3**

2030 Aviation System Air Cargo Tonnage (x 000)
(All Variations evaluated)

	BUR	JWA	LAX	LGB	MAR	ONT	PSP	PMD	SBD	SCL	TOTAL
Constrained (No HSR)	83	43	3,268	123	825	2,605	146	143	821	283	**8,340**
Moderate (ONT 3 rwys)	84	43	3,210	133	1,053	2,272	125	145	1,114	361	**8,540**
Preferred Aviation Plan	87	43	2,340	137	1,117	2,252	128	1,024	1,092	504	**8,724**
Preferred Aviation Plan (no HSR)	87	43	2,379	137	1,104	2,188	128	866	1,050	476	**8,458**

2010 and 2020 Interim Forecasts
Preferred Aviation Plan
Passengers (MAP) and Cargo Tonnage (x 000)

	BUR	JWA	LAX	LGB	MAR	ONT	PSP	PMD	SBD	SCL	TOTAL
2010 Passengers	7.4	10.2	73.7	2.5	0.5	10.3	2.1	1.1	0.7	0.2	**108.7**
2010 Cargo	60	41	1,570	86	132	876	82	119	253	81	**3,300**
2020 Passengers	10.7	10.8	78.0	3.8	2.9	18.1	3.1	5.5	4.2	1.8	**138.9**
2020 Cargo	87	43	2,059	133	627	1,536	123	605	756	343	**6,312**

RADAM AVIATION MODELING FOR THE 2004 REGIONAL TRANSPORTATION PLAN: DEFINITIONS AND ASSUMPTIONS

A. Basic Definitions and Assumptions

*1. **Basic Factors** addressed by the model for each aviation system scenario modeled include:*

- Number of Flights by Haul
- Load Factors
- Airport Hours of Operation
- Flight Portfolio
- Aircraft Seating
- Terminal Capacity
- Parking
- Special Generators
- High Speed Rail
- Airfare
- Airport Access Mode Choice
- Catalytic demand
- Market Incentives

Most of these factors are input to the RADAM model as airport-specific assumptions, as either actual conditions at existing airports, or hypothetical conditions at new and/or existing airports to test possible future conditions. Other factors deal with either the generation of regional aviation demand or the linking of this demand with airports, including special generators, catalytic demand, market incentives, airport access mode choice, and high speed rail.

2. **Flight haul** is defined by duration of passenger flights. This definition is expressed in time, not miles as defined by the FAA. Passengers equate travel time to length of flight. Travel times are consistent with distance.

Definition By Hours of Flight	Definition by Miles (As per FAA)
0-1 hours: short-haul (SH)	0- 200 miles commuter (as per FAA)
1-2 hours: medium-haul (MH)	0 -600 miles Short Haul
3-4 hours: long-haul (LH)	600-1,200 & 1,200-1,800 Medium Haul
4+ hours: international (INT)	1,800-2,400 Long Haul

3. **Load Factor** is the number of passengers on board an airplane, expressed as a percentage of the total available seating capacity provided by the specific aircraft configuration. Effective Load Factor refers the actual load factor. Initial Load Factor represents airline requirements for providing start-up service at new airports. Minimum load factors refer to the threshold load factors that airlines require in

providing sustainable, economically feasible service. General minimum load factor guidelines used are as follows:

55% for commuters
60% for air carrier domestic
65% for air carrier international medium-, and long-haul

Load factors lower than the above may occur but are generally not considered economically sustainable.

4. **Airport Hours of Operation** reflect current hours of operation at established airports, reflecting legally enforceable curfew and other limitations. Hours of operation at new airports are sufficient to accommodate forecast demand.

Assumed hours of operation at each airport are as follows:

LAX--ONT – 24 Hrs
BUR--15 (10pm-7am voluntary curfew)
SNA--15 (10pm-17am mandatory curfew for departures)
LGB--17 (11pm-6am mandatory curfew)
ONT—24 Hrs
PSP--15 (10pm-7am mandatory curfew)
MAR--24 (Constrained by military ops)
SBD –24 (Unconstrained)
PMD –24 (Unconstrained)
SCL –24 (Unconstrained)

5. **Flight portfolio** refers to the composition of different aircraft flights provided by haul length. Generally speaking, smaller airports offer air taxi, commuter and short haul operations and serve limited short-haul destinations. Historically as airports have grown, commuter and short-haul service would be supplanted with longer haul and eventually international service. International service would increase the domestic feeder base by virtue of a multiplier effect. However, the historic growth models have always applied to growing and unconstrained airport systems. Thirty years from now, the regional airport system in Southern California will be subject to entirely different pressures associated with service limitations at urban airport. As a result, the outlying suburban airports will not necessarily follow the traditional growth patterns and will offer more accelerated or advanced flight portfolios. Under certain circumstances, such as multi-airline brokerage scenarios, the portfolios of outlying airports are matured through cooperative agreements to include higher services at significantly lower passenger levels. Certain brokerage scenarios include operational assumptions facilitating the transfer of passenger and flights to outlying airports while limiting the loss or diversion of passengers and service to other competing airports.

6. **Aircraft seating** refers to the number of available seats in an airplane, depending on aircraft type, series and particular airline seating configurations. Certain aircraft are used in a dual mode (as both air cargo and passenger carriers) and do not

provide nominal seating capacities. The following are the general seating guidelines by haul type:

Commuter: 14-80 seats
Short-haul: 78-190 seats
Medium-haul: 90-300 seats
Long-haul: 210-580 seats
International: 220-580 sets

Seating capacities vary by aircraft type, series, production run and specific airline seating configurations. Configurations offering a greater number of first class and business class seats have a proportionally lower overall seating capacity due to additional floor space requirements.

7. **Terminal capacity** relates to square footage (ratio of persons per square ft.), number of gates, security system space and convenience. Since 9/11, terminal space requirements have been upgraded to reflect additional needs for security, screening and luggage-related operations. The latest version of the civilian RADAM model relies on observed empirical passenger flows, queuing and saturation thresholds at various airports by gate category, aircraft type, load factor, time of day and collateral congestion from adjacent gates and shared security ingress points. Terminal capacities and flows are instrumental in assessing the ability of airports to serve passengers on time and, when necessary, to use this parameter as a means of constraining airports. For example, the current round of modeling of LAX relies on aircraft gate restrictions developed by the LAX Master Plan process to serve as capacity-limiting factors.

8. **Parking** is another airport attribute, which favors the outlying airports due to lower real estate costs and greater space availability. Parking spaces are subdivided into various categories ranging from disabled, nominal to compact and electric car parking. Parking costs are also considered. Some scenarios can be developed in which parking is used to determine tee impact of various pricing and parking configurations on passenger reallocation among the available airports now and in the future. Various parking attributes have been used extensively by SCAG-developed incentive packages to specifically consider the advantages of outlying airports to provide greater levels of convenience. However, in the Constrained Variation and the Preferred Aviation Plan in the 2004 RTP:

- All airports are assumed to be unconstrained in terms of parking with a level of service equal to 2002.
- Parking at outlying airports is assigned a higher service index due to the ability to provide superior flows at reduced costs.
- Parking costs at existing airports were based on recent values.
- Parking at new airports was projected to reach high levels of service consistent with local parking attributes (i.e. lower percentage saturation, lower cost, simpler configuration, greater proportion of nominal spaces, wider aisle, etc.)

9. **Special Generators** are destination locations, which attract large numbers of passengers, particularly tourists. Examples are Disneyland, Universal Studios, and Hollywood.

10. **High-Speed Rail** (HSR) includes different HSR alignments, ridership patterns and speeds to airports. The RADAM HSR model includes over a hundred sub models ranging from various seating capacities speeds and turnover times at stations to passenger demand attributes from both the U.S. and abroad. Different models are used for HSR and Magnetic Levitation (Maglev). Most importantly Maglev would not only serve in its “pure transportation mode” but also exert catalytic effects in terms of land use development and inducing additional passenger ridership by virtue of being a technological breakthrough. The basic assumptions relating to Maglev for scenarios that incorporate Maglev connections to airports include:

- Theoretical maximum speed 200 mph; actual operational speeds may be less due to prolonged upgrades and curves due to topography and frequency of stops in urban areas.
- Maglev trains running every 10 minutes with unconstrained load factors.
- Bi-directional service as well as service in only one direction, if desired, to divert passengers to specific airports or Maglev alignments.
- Ridership can be assessed for passengers as well as non-airport ridership with and without persons accompanying air travelers.
- Extensive, unconstrained shuttle van service to Maglev stations was included using a maximum of 7-9-mile shuttle van radius.
- Maglev service to Palmdale was subsidized (20% less). For modeling of the Preferred Aviation Plan, shuttle van service is offered to all outlying airports in combination with the airfare/MAGLEV consolidated price structure. For prospective PMD passengers, the sensitivity to traffic congestion was also increased by 15%, and route reliability by 12%, where applicable.

11. **Airfare**, although instrumental in generating passenger markets or intensifying demand for particular city-pairs, was excluded as a variable in the modeling of aviation system scenarios for both the 2001 and 2004 RTPs (I.e., airfare parity between airports was assumed). However, airfare is indirectly accounted for through a variable that addresses percentage of flights provided by discount carriers.

12. **Airport access mode choice** covers up to 22 possible modes of airport ground access, and more uniquely it includes composite mode choice to airports, as some passenger use more than one access mode. Mode choice options for new airports are based on passenger travel histories contained in extensive databases and changes that occurred since 1992 and particularly since 9/11. Mode choice options include conventional modes such as cars and buses, as well as various HSR and Maglev-related composite mode choices.

13. **Catalytic demand** plays a pivotal role in airport growth and land use patterns around major new airport sites. It represents additional demand that results from the attraction of development and employment to new or expanding airports with developable land around them. The types of businesses that are attracted to airports are airport-dependent, and value close proximity to airports. They include multi-national firms, companies engaged in international trade, and service companies whose employees fly very frequently to service clients in far-flung locations. They also include businesses that produce high value-to-weight ratio and/or time-sensitive products that are conducive to air transport. While catalytic demand already shows up at existing, established airports, it is a new impact and source of new passengers and cargo for emerging airports, or military airport conversions. As much as airports complete for a common regional and international passenger market, so does catalytic demand. Several new airports will experience competition for catalytic economies and inter-regional business. Catalytic demand was specifically included in RADAM aviation modeling for the 2004 RTP.

15. **Market incentives** can be assumed to make certain airports more attractive to air passengers, which will boost their passenger allocations in relation to other airports in the system. Market incentives that have been used in the modeling of past aviation system scenarios include increased passenger perception of route reliability to distant airports (implying future ground access improvements), increased passenger awareness of airports as travel options (implying marketing programs), free or low-cost parking, and free shuttle service from activity centers to airports.

B. <u>Assumptions Used for Modeling of 2004 RTP Plan Variations</u>

General parameters that can produce major differences in air passenger and cargo allocations between airport system scenarios when modified include the following:

- Number and location of new commercial airports assumed
- Service portfolios assumed at new commercial airports
- Constraints at existing airports assumed (policy or capacity)
- High-speed rail alignments assumed
- Major ground access projects assumed
- Market incentives assumed
- Forecast dates assumed

For the Constrained Variation and Preferred Aviation Plan carried into the 2004 RTP from the scenario evaluation process, the same number of existing and proposed new commercial airports were assumed. Existing airports include Los Angeles International (LAX), Bob Hope (BUR), Long Beach (LGB), John Wayne (JWA), Ontario (ONT) and Palm Springs (PSP) airports. New airports include Palmdale (PMD), San Bernardino International (SBD), March Inland Port (MAR), and Southern California Logistics (SCL) airports. It should be noted that Palmdale has accommodated limited commuter passenger service in the past, and San Bernardino and Southern California Logistics have both accommodated limited charter service for both passengers and cargo.

The **general parameters** that were assumed for the Constrained Variation and Preferred Aviation Plan are listed below. MAP stands for million annual air passengers.

Constrained Variation

- LAX: Existing physical (runway) capacity of 78 MAP
- BUR: Existing physical (terminal gate) capacity of 9.4 MAP
- LGB: Existing flight restriction of 41 flights/day, or 3 MAP
- JWA: New Settlement Agreement constraint of 10.8 MAP
- ONT: Existing physical (runway) capacity of 30 MAP
- SBD and PMD: Cargo, charter corporate aviation, and commuter/short haul passenger service
- MAR and SCL: Cargo charter and corporate aviation only
- No Maglev system assumed
- Airport ground access improvements assumed are those currently planned
- Market incentives assumed for outlying/suburban airports, including:
  - For PMD, perceived ground access reliability assumed to be the same as for other airports; i.e., no penalty assumed for Rte. 14 being the only major access route to PMD, and subject to unpredictable delays from non-recurrent congestion caused by accidents. This implies one or more additional major access routes to be constructed to PMD.
  - For PMD, future air trip propensities in the Antelope Valley increased by 15% to bring it close to the average for the San Fernando Valley. This implies a maturing of the population and employment base with more disposable income, more confluence with and less isolation from the San Fernando Valley, and higher propensities stimulated by an expanding PMD
  - For PMD, SBD, MAR and SCL, assumed that 100% of all resident passengers and 80% of non-resident passengers would be aware of them as airport choice options. This implies an ambitious marketing campaign, and full representation of the airports in the computerized flight reservation booking system
  - Low-cost parking at PMD, SBD, MAR and SCL assumed
  - Free shuttle service from major activity centers to PMD, SBD, MAR and SCL assumed
- 2030 forecast date

The basic assumption of this alternative regarding service constraints at outlying/suburban airports is that the current financial plight of airlines would continue for some time, and that they would not have substantial resources to invest in services at new or expanding airports. It should also be noted that the application of market incentives in this alternative on passenger and cargo allocations had limited impact, because of service constraints assumed at outlying/ suburban airports.

Preferred Aviation Plan

- LAX: Existing physical (runway) capacity of 78 MAP
- BUR: Three new remote terminal gates assumed, increasing its physical capacity to 10.7 MAP
- LGB: Larger aircraft with higher load factors assumed within the 41 flights/day airport restrict, increasing its capacity to 3.8 MAP
- JWA: New Settlement Agreement Constraint of 10.8 MAP
- ONT: Existing physical (runway) capacity of 30 MAP
- SBD, PMD, MAR and SCL: All unconstrained
- Full Maglev system assumed
- Airport ground access improvements from unconstrained list (i.e., recent submittals from local transportation commissions)
- Market incentives assumed for outlying/suburban airports (same as Constrained Variation, but much greater impact)
- 2030 forecast date

The Specific parameters that were assumed for the Constrained Variation and the Preferred Aviation Plan that address more specific and technical aviation system characteristics are listed below. The major difference between the application of these parameters to these two aviation system alternatives is that the Preferred Aviation Plan assumed much more robust flight portfolios at outlying/suburban airports. This was due to the airline “brokering” features of its implementation plan and emphasis of Maglev passenger ridership to airports including integrated fares that combine Maglev fares with airfares. The specific parameters assumed in the modeling of the two alternatives are as follows:

Constrained Variation

- Flight Haul: Restricted by runway-aircraft compatibility
- Load Factors: Updated load factors since 9/11, by haul type
- Airport Hours: Basic assumptions
- Flight Portfolio: Conventional model of commuter/short haul initial base
- Aircraft Seating: Basic seating assumptions by haul type
- Terminal Capacity: Capacity limiting factor at BUR
- Parking: Basic assumptions
- Special Generator: Basic assumptions
- Airfare: Basic assumptions
- Airport Mode Choice: Basic assumptions
- Catalytic demand: Assumed. However, impact limited because of capacity or service constraints placed on all airports

Preferred Aviation Plan

- Flight Haul: Restricted by runway-aircraft compatibility. Flight hauls at suburban airports not subject to traditional flight growth patterns.

- Load Factors: Updated load factors since 9/11, by haul type.
- Airport Hours: Basic assumptions
- Flight Portfolio: Flight service brokerage assumed that shifts passengers and services to outlying airports using MAGLEV; Flight portfolio of PMD assumes international service as a function of MAGLEV connection to LAX rather than the traditional airport growth model. Multi-airline consortium/brokerage of services also limits loss of passengers to other regions.
- Aircraft Seating: Basic seating assumptions by haul type
- Terminal Capacity: Capacity limiting factor at BUR, with remote aircraft parking assumed
- Parking: Basic assumptions
- Special Generator: Basic assumptions
- Airfare: Integrated airfare/MAGLEV fare structure
- Airport Mode Choice: Basic assumptions
- Catalytic demand assumed

C. Capacity Constraints at Urban Air Carrier Airports

This section presents a more complete description of the methodology uses to determine the physical and policy capacity constraint at the five urban air carrier airport in the region.

LAX

In aviation system planning conducted for SCAG's 2001 Regional Transportation Plan (RTP), a physical capacity analysis was conducted of LAX that the existing capacities of the facility's curbside, terminal, terminal gate and runway systems. It determined that the overriding constraint that governs the physical capacity of LAX is its runway system. This analysis evaluated the ability of the LAX runway complex to accommodate landing aircraft (i.e., runway aircraft acceptance rate) during peak and off-peak periods. Future (2015) aircraft load factors were derived from RADAM model forecasts, and future aircraft fleet mixes were derived from data from the LAX master plan process. When unacceptable delays occurred during peak periods because of runway limitations, operations were spread to off-peak periods within the range of tolerance expressed by passengers in the RADAM air passenger surveys for off-peak travel. Using this methodology, the LAX runway capacity was estimated at 78 MAP. This capacity constraint was adopted for the 2001 plan, and carried over into the 2004 RTP. It should be noted that Los Angeles World Airports (LAWA) has estimated the existing runway capacity of LAX at about 86 MAP. Also, if the LAX capacity analysis was updated using SCAG's updated 2030 regional aviation forecast, that accounts for increased aircraft load factors after 9/11 and more very large aircraft in the future fleet mix, the estimate of existing runway capacity at LAX would be above 78 MAP.

The latest Preferred Alternative being proposed by Los Angeles World Airports (LAWA) in its LAX Master Plan process is Alternative D. This alternative proposes extensive improvements to the existing LAX runway complex, which would likely increase the runway capacity of the facility well above 78 MAP. However, Alternative D also proposes to hold the capacity of LAX to 78 MAP through reconfiguring the terminal complex and reducing the overall number of terminal gates from 163 nominal gates to 153 nominal gates.

Bob Hope

For the 2001 RTP a capacity analysis was also conducted for Bob Hope (formerly Burbank) Airport, which concluded that the overriding capacity constraint at that facility was terminal gate capacity. Given the airport's 14 gates, forecast load factors and typical gate turnover times at the airport, produced a maximum utilization rate of about 670,000 passengers per gate. Going beyond this limit would lead to a deterioration of overall airport service capacity since it would exceed the ability of most airlines to process and load air passengers. The maximum gate utilization rate applied to the airport's 14 gates yielded a maximum physical capacity of about 9.4 MAP.

For the Constrained Variation in the 2004 RTP, Bob Hope Airport's existing physical capacity was raised slightly to 9.6 MAP, since forecast load factors have been slightly upgraded after 9/11. In the Preferred Aviation Plan, three new remote aircraft parking positions were assumed on the southwest corner of the airfield, where it was determined that there is room for up to five additional parking positions, depending on aircraft size and orientation. These parking positions, which could be accessed by shuttle from the terminal, could function essentially as gates since Bob Hope passengers currently walk to parked aircraft from the terminal building (gates are currently limited by available space to park aircraft). The three gates would have a maximum utilization rate of 367,000 passengers each, much less than the existing gates. Their ability to serve passengers would be limited by longer aircraft taxiing and turning times, longer access times for passengers and baggage, and longer aircraft turnover times (for fueling, inspection, delivery of supplies, etc.). The new aircraft parking positions assumed would displace no general aviation activities.

The Burbank-Glendale-Pasadena Airport Authority has been trying for a number of years to construct a new terminal complex to the north of the existing structure. The new facility would be in compliance with FAA safety standards and would not increase the capacity of the airport since it would be held to 14 gates. However, there has been considerable public opposition to the new terminal and the various parties involved in the issue are currently at a stalemate. As of May 2003 the FAA has requested that all grant money given to the airport to be used on land acquisition for the new terminal be returned. The Airport Authority is still trying to reach an agreement with the FAA on these funds.

Long Beach

In the early 1980's, the City of Long Beach imposed a restriction of 15 air carrier operations/day on Long Beach Airport, which was determined to be consistent with holding noise levels in impacted neighborhoods under the State-mandated 65 CNEL contour. A Federal judge subsequently ruled in favor of the airlines, lifting the cap incrementally to 41 air carrier departures/day. This constraint is still in force, by virtue of a 1995 Settlement Agreement between the city and the airlines that was prompted by a 1991 Federal circuit of appeals decision to reverse all previous major legal findings. The 41 departures/day cap (25 commuter flights are also allowed) equates to a range of potential passenger service, depending on the aircraft types, load factors and number of cargo flights assumed (there currently are five all-cargo flights). The city's noise ordinance for the airport was grand fathered by the 1990 Federal Airport Noise Capacity Act (ANCA), which precludes new local restrictions on Stage 3 aircraft.

With the passage of Orange County's Measure W in March 2002, which eliminated commercial airport use of MCAS El Toro, there has been significant airline interest in Long Beach Airport. As opposed to several years ago, when the airport was having difficulty promoting itself to passenger airlines, all airline slots at Long Beach have now been taken. Jet Blue Airlines" has reserved the 27 available commercial slots, planning to fill the slots over the next two years. Several airlines have requested to utilize the reserved, but currently unused slots. The introduction of discount airline service at Long Beach by Jet Blue has been instrumental in the recent surge of passenger activity at the airport, which increase from 0.6 MAP to 1.45 MAP from 2001 to 2002.

The flight restriction at Long Beach translates to 3.0 MAP, making conservative assumptions. These include assuming the existing air carrier fleet mix, a nominal 60% load factor, and that the 25 allowable commuter flights are divided between regional jets (10 flights at 70 passengers seats per aircraft) and smaller turbo props (15 flights at 25 seats per aircraft). The 3.0 MAP figure for Long Beach was used for the Constrained Variation. Making more liberal assumptions increasing the forecast total for Long Beach to 3.8 MAP, which was used for the Preferred Aviation Plan. These include assuming a 70% overall load factor, and that all the 25 commuter flights would be regional jets in 2030.

John Wayne

Like Long Beach Airport, John Wayne Airport also has a legally enforceable noise restriction (i.e., Federal Court Settlement Agreement) that originated from contentious noise litigation and resulted in airline service restrictions. For John Wayne, it was between the City of Newport Beach (aligned with two citizen groups) and the County of Orange. The agreement, developed in 1985 and set to expire in at the end of 2005, restricted the airport to 8.4 MAP and 73 average daily departures for aircraft generating more than 86 db of single-event noise. In December 2002 the FAA approved a new and modified Settlement Agreement developed by the original signatories, and approved by the airlines at the airport. It increases the number of noise regulated flights allocate to the commercial passenger carriers from 73 to 85 average daily departures, and doubles the number of permitted air cargo flights from two to four. It also and increases permitted passenger service levels from 8.4 MAP to 10.3 MAP effective in 2003, and to 10.8 MAP effective 2011 through 2015.

Ontario

A new runway capacity analysis was performed for Ontario Airport for the 2004 RTP. A previous capacity analysis performed for the 2001 RTP by SCAG aviation staff for the airport's existing two runways, using a relatively simplistic average service volume (ASV) analysis, estimated the capacity at about 20 MAP. For the 2004 RTP a more sophisticated RADAM runway capacity analysis was performed, similar to the LAX runway capacity analysis previously described. This new evaluation estimated the capacity of Ontario's two-runway complex at about 30 MAP. A three-runway complex at Ontario with a new commuter runway was estimated to be able accommodate about 38 MAP. However, the three-runway alternative was rejected by the SCAG Aviation Task Force because of potential environmental impacts, and was not included in the Preferred Aviation Plan. It is important to recognize that the runway capacity analyses performed for Ontario Airport assumed substantial amounts of regional air cargo being served by other Inland Empire Airports including San Bernardino International, March Inland Port, and Southern California Logistics airports. It has been argued that the "herd mentality" of the air cargo industry will dictate that cargo will only move to these alternate airports when available air cargo handling capacity at Ontario Airport is saturated. Since most air cargo now moves by dedicated freighters, if this becomes the case if would significantly reduce available runway capacity at Ontario for moving air passengers over the long term.

Ontario Airport is also subject to a 12 MAP/125,000 annual air carrier operations constraint imposed by the California Air Resources Board (CARB). This constraint originates from Federal Aviation Law, which stipulates that airports that receive federal funds for runway construction must be certified by the state that they are in compliance with all state and federal air quality standards. In the State of California, this responsibility has been delegated to the CARB. In 1977 the CARB certified Ontario's new runway at this level, since its existing runway was deemed to have the capacity to accommodate 125,000 operations at 12 MAP. The City of Los Angeles has since contested the constraint, claiming that because of unanticipated growth in all-cargo activity and smaller air carrier aircraft, they won't be able to reach the 12 MAP passenger level with 125,000 air carrier operations. Both parties have put the issue on hold until the airport reaches the 125,000 operations ceiling, which should occur within this decade. At that point in time, an air quality mitigation plan will have to be developed and approved for the airport to be re-certified (the airport operates under a joint Caltrans/CARB operating permit).

The Ontario air quality constraint is therefore not an absolute growth ceiling, since the airport can be re-certified at a higher growth level if it submits an acceptable mitigation plan. Sacramento Airport is the only other airport in California that is subject to this requirement. The airport is subject to additional mitigations and reporting requirements compared to other airports in order to meet the approval of the CARB, but it has nevertheless been able to expand to meet rapidly growing aviation demand in the Sacramento Region.

ESTIMATED AIRPORT CAPITAL IMPROVEMENT COSTS TO IMPLEMENT PREFERRED REGIONAL AVIATION PLAN

A. Summary

The current Southern California airport system will need substantial upgrading to handle the 170 MAP in 2030 that is forecast in the Preferred Aviation Plan. The total existing airport capacity at the SCAG region commercial airports, assuming no future investments in terminal or runway improvements, is approximately 115.5 million air passengers (MAP). This represent a shortfall of almost 55 MAP for 2030 when compared to the 170 MAP forecast for the Preferred Plan. To meet this forecast significant improvements will need to be made at almost every airport in the region.

Based on current case studies and airport master plans, a total of about $4.85 billion[1] will be needed to construct the necessary facilities to implement SCAG's 2030 Preferred Regional Aviation Plan, as shown in Table 1. The estimation methodology and cost assumptions for each airport are described below.

Table 1

Estimated Airport Capital Improvement Costs To Implement Preferred Regional Aviation Plan

Airport	*2002 MAP*	**2002 Capacity**	**Forecast 2030 MAP**	**Estimated Investment**
Bob Hope	4.6	9.4	10.7	$20 million
John Wayne	7.9	8.4	10.8	$200 million
Los Angeles Int'l	56.2	78	78	$10 billion[1]
Long Beach	1.5	3.8	3.8	$7 million
March Inland Port	0	0	8	$700 million
Ontario Int'l	6.5	10	30	$1.5 billion
Palm Springs	1.1	1.9	3.2	$122 million
Palmdale	0	2	12.8	$1 billion
San Bernardino	0	2	8.7	$850 million
South CA Logistics	0	0	4	$450 million
TOTAL	**77.8**	**115.5**	**170.0**	**$4.85 billion[1]**

[1] The $4.85 billion does not include any proposed improvements to Los Angeles International Airport (LAX) under the currently proposed Master Plan Alternative D. The improvements at LAX (estimated at $10 billion) do not enhance capacity and thus are unrelated to necessary expenditures needed to meet demand. The LAX Master Plan Alternative D is included in this report for informational purposes only.

B. Methodology

Facility improvement costs were estimated through a number of sources. When possible, the current airport master plan was used, or drafts of the unfinished master plan.

In cases where no master plan was available, or the necessary improvements were not included, total costs are estimated in 2002 dollars. The numbers were derived from comparing case studies of other U.S. airports that are planning, constructing or finishing capital improvement projects. Denver International Airport and Austin International Airport were used as benchmarks for estimating facility costs for comprehensive airport development projects. Boise International Airport, San Francisco International, Houston InterContinental, Las Vegas and Detroit International Airport all recently completed new terminals of various sizes and functions. These facilities were used as benchmarks to estimate facility costs for proposed international terminal improvements at Palmdale Airport.

The size of needed terminal facilities was estimated by examining comparable airports (in terms of passenger enplanements) and averaging how many gates are needed. International airports tend to have more space requirements for U.S. Customs, hold rooms and longer aircraft turn times; this was taken into account. The larger the project, the lower the incremental cost per gate. In other words, an 8 MAP facility is not quite double the cost of a 4 MAP facility.

The cost of ground access, airfield improvements and rental car facilities were mostly derived from the benchmark case studies. The most useful case studies were Boise International, Palm Springs International and Austin International, since they provided cost breakdowns for individual facility elements. One major cost savings in the SCAG region is land acquisition, since the airports that need new facilities already have almost all the land necessary to accommodate them. It should be noted that SCAG's proposed Maglev system was not included in any of the facility cost estimates.

These airport facility costs are preliminary estimates. Security regulation changes, environmental policy, construction costs, demolition and time delays, and other factors could significantly impact these estimates.

C. Airport Capital Improvement Cost Estimates

1. Bob Hope: $20 million

The only capital improvement needed at Burbank to achieve the Preferred Aviation Plan forecast of 10.8 MAP would be the demolition of three structures on the south end of the airfield to allow for 3 to 5 remote aircraft parking positions. Some minimal taxiway and ramp work done would also be needed. This figure was derived from examining details of demolition and moderate ramp work at the Boise Airport and Palm Springs.

2. John Wayne: $200 million

The airport is currently in the early stages of designing a new terminal that will be able to accommodate the 2030 forecast of 10.8 MAP. It is hoped that this new terminal will be fully operational in the next five years. The new terminal will have a total of 20 gates. The $200 million estimate was derived by applying the amount John Wayne spent to construct the current terminal facility to the number of new terminal gates that will be added.

3. Los Angeles International: $10 billion

The airport's current Preferred Master Plan Alternative is Alternative D, which focuses on safety and security. The $10 billion is derived from judgement, local newspaper articles and studies. The money would fund terminal demolition and reconstruction, significant runway and taxiway improvements, a ground transportation center, a rental car facility and numerous other ground access improvements. Alternative D does not increase the capacity of LAX beyond the 2030 forecast of 78 MAP, so its $10 billion estimated cost was not added to the airport capital improvement cost estimate total.

4. Long Beach: $7 million

The City of Long Beach is beginning to plan and design a supplemental terminal structure that can accommodate the legally allowed 41 commercial and 25 commuter flights per day. Additional vehicle parking will also be constructed. In 2030 Long Beach is forecast to have 3.8 MAP. The $7 million figure is a preliminary estimate made by the City of Long Beach, which could be significantly higher at the conclusion of the project.

5. March Inland Port: $700 million

This funding would pay for an 18 to 22 gate terminal facility that could accommodate the Preferred Aviation Plan forecast of 8 MAP. The terminal would be similar in size to the newly constructed Austin International Airport. The $700 million would pay for ground access, parking facilities, rental car facilities, a new terminal structure, and air carrier ramp improvements. Not included in this cost are any needed runway/taxiway improvements, or air cargo facilities (which are typically constructed by tenants).

6. Ontario International: $1.5 billion

The airport master plan is currently being developed by Los Angeles World Airports. LAWA, the City of Ontario and the County of San Bernardino agree on the conceptual capacity of 30 MAP. The current terminal facilities can handle about 10 MAP. There will need to be an additional terminal constructed and significant improvements made to vehicle parking, ground access and ramp space. The facility would need a minimum of 75 gates to accommodate 30 MAP in 2030 (50 gates more than current). At 30 MAP Ontario would be similar in size to San Francisco International. A new 50 gate terminal would be similar to the newly completed 64 gate MacNamara Terminal at Detroit Metro Airport. Preliminary estimates from the ongoing Ontario Airport master planning process, provided to SCAG by Los Angeles World Airports (LAWA), indicate that needed improvements will cost from $1.3 billion to $1.7 billion. An estimated cost of $1.5 billion to expand Ontario Airport to accommodate 30 MAP was therefore used.

7. Palm Springs: $122 million

The Palm Springs Airport Master Plan forecasts 2.7 MAP by 2020, about 0.5 MAP less than is forecast in the SCAG Preferred Aviation Plan in 2030. The $122 million would pay for a second passenger terminal consisting of 11 air carrier gates, check in facilities, baggage claim area and additional vehicle parking. These figures come from the recently completed airport master plan.

8. Palmdale: $1 billion

In order to handle the Preferred Aviation Plan forecast of 12.8 MAP in 2030 the airport will need to undergo significant capital improvements. A new terminal that has between 28-35 gates, with office space for U.S. Customs, USDA and the Transportation Security Administration (TSA) will be required. The airport will have a strong international focus that will require more room for aircraft parking, maintenance, catering and passenger processing. Issues relating to the current operating agreement with Air Force Plant 42 that limit operations and facility improvements will need to be addressed. Significant ground access improvements and long-term parking will be necessary for a Palmdale Airport with a strong international portfolio. The 2030 forecast of 12.8 MAP is similar to current passenger activity at Oakland International Airport.

9. San Bernardino International: $850 million

San Bernardino is forecast to serve 8.7 MAP in 2030. To accommodate this growth a new passenger terminal will be needed, or significant modifications made to the existing terminal structure. The current terminal space would only be able to handle a maximum of 15% of the forecast growth. The airport will need a total of between 20-25 gates. Significant demolition of facilities and reconstruction may be needed. However, the available ramp space is very adequate for this type of facility. The $850 million allows for new parking facilities and extensive ground access improvements, but does not include the proposed second runway or any additional air cargo facilities. San Bernardino International at 8.7 MAP in 2030 would be comparable to current passenger activity at Sacramento International Airport.

10. Southern California Logistics: $450 million

This airport will need a new passenger terminal facility, passenger parking, ground access improvements and ramp improvements. The $450 million in improvements estimated for the airport would fund a terminal with 14-18 gates. With a 2030 forecast of 4 MAP the airport would be similar to current passenger activity at Reno/Tahoe International. There is adequate space at Southern California Logistics for a new terminal structure. The cost estimates for this airport were derived mostly from case studies of Boise International and Palm Springs International.

RADAM AIRPORT DEMAND ALLOCATION MODEL—BASIC DESCRIPTION

A DISCUSSION PAPER FOR THE SCAG AVIATION TASK FORCE RADAM MODEL WORKSHOP

(UPDATED 10/16/03)

A. Introduction

The Regional Airport Demand Allocation Model (RADAM) is a state-of-the-art multinomial logit (MNL) model that generates and allocates current and forecast air passenger and cargo demand to airports. It was originally developed by the consultant firm Advanced Transportation Systems (ATS)[2] and subsequently used for SCAG's 1994 Southern California Military Air Base Study in order to estimate the potential of closed or downsized military air bases in the region to attract air passenger demand as commercial airports. It was designed to significantly improve upon the level of accuracy that is obtainable in assessing the allocation of passenger demand between competing airports in complex multi-airport systems using more conventional gravity or MNL models. SCAG aviation staff's disappointing experience with simple gravity models in previous system studies led to the conclusion that a new and innovative analytical tool such as RADAM was needed to accurately assess the impacts of major capacity expansion proposals on our multifaceted regional aviation system. A much more sophisticated methodology was also needed that was capable of testing a range of airport system scenarios that are differentiated by a wide variety of discreet variables.

The RADAM model is a "bottoms up" model, generating air passenger and cargo demand by a geographically based zonal system (i.e., transportation analysis zones) that are compilations of SCAG transportation analysis zones (TAZ). Socio-economic data by TAZ is used in combination with airport choice criteria to generate passenger forecasts and allocations in terms of baseline, catalytic, and total air passenger demand for airports in actual or theoretical airport systems.

In the regional configuration, the model distinguishes three basic passenger categories (business, non-business and all-inclusive tours). Each passenger category is represented through discreet sets of cascading multinomial logit/probit equations addressing commuter, short-, medium-, and long-haul travel. International travel is represented through more refined calibrations for Europe, the Pacific Rim, South America, Canada and Mexico. The commuter module distinguishes between basin (intra-regional) and inter-regional passengers.

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[2] ATS and the various civilian and military configurations of the RADAM model had been acquired by Citigroup Technologies Corporation, which holds all the model patents.

With its nested structure of thousands of systems and subsystems, RADAM is a highly interactive model. The modular construction of RADAM enables it to respond to the complexities of the regional multi-airport system of Southern California with its myriad of future possibilities and concerns. It has the specificity, flexibility and adaptability to test a wide variety of future actions at individual airports on passenger and cargo demand distributions within the entire regional system. Various alternatives can be tested including capacity and policy constraints at existing airports, addition of new airports anywhere in the region, partially unconstrained scenarios (in terms of types and number of aircraft operations that the market will support at different airports), and fully unconstrained scenarios. The RADAM methodology can also evaluate the potential shifts in passengers between airports from constructing intra-regional high-speed rail systems, as well as estimate vehicle-miles-traveled (VMT) and related ground access emissions associated with any particular scenario.

Besides the 1994 study of military air bases, RADAM has also been employed in SCAG's 1995 NAWS Point Mugu Joint Use Feasibility Study, 1996 George AFB Air Quality Conformity Study, 1997 March AFB Joint Use Feasibility Study, and 1998 and 2001 Aviation System/Regional Transportation Plan studies. It has also been used in the LAX and MCAS El Toro master plan studies. The military version of RADAM has been used successfully by Citigroup Technologies Corp. as a key planning tool by NATO and the U.S. military for recent overseas deployments.

The RADAM methodology is in a continual state of refinement, and has recently been refined and updated specifically for SCAG's 2004 Aviation System/Regional Transportation Plan Study. Many of these recent refinements incorporate significant changes in the airline industry and passenger perceptions about air travel that occurred after the events of September 11, 2001. Changes since 9/11/01 were identified through spot air passenger surveys, travel agent surveys, and more significantly credit card databases that identified ticket purchases patterns and characteristics. Major refinements that have been made to either the internal calibrations of the RADAM model or to model inputs include:

- Geographic redistribution of passenger and reduction in trip propensities due to 9/11/01.
- Increased passenger tolerance to delays, flight frequency reductions and other inconveniences at airports.
- Changes in time before departure requirements by flight haul.
- Changes in party size
- Major security related delays at urban airports
- Increased passenger interest in alternate secondary airports with fewer delays
- Changes in passenger sensitivities to ground access congestion
- Temporary central terminal area parking removal
- Curbside dwell time reductions
- More competitive air fares
- Greater shift to point-to-point travel

- Reduction in flights, and flight consolidation
- Fleet mix reconfigurations and delays in aircraft acquisitions
- Emphasis on increased load factors and returns on revenue miles
- Recession in the Atlantic and Asia/Pacific passenger markets
- Decline in airline fiscal ability to invest in outlying airports
- Rapid growth in corporate (private jet) air travel
- Residual effects of Iraq war and biological events (SARS)

B. Conventional Models

Conventional statistical airport models invariably suffer from an inability to realistically replicate air passenger behavior. These models typically rely on highly abstract and theoretical compute-generated databases for critical input data to replicate complex airport choice behavior. Inaccuracies associated with such data sources are then carried over into the passenger forecasting process. As a result, calibrations and validations of airport models often become exercises in balancing errors from a number of different databases due to incompatibilities.

Due to a lack of comprehensive and consistent data on regional airports, and even less on passenger behavior, most passenger forecasting models utilize a few simple, surrogate variables, such as access times, number of flights and a cost factor to allocate passengers to airports. Access times are typically derived from sophisticated traffic models that generate theoretically exact travel times to alternative airports as one of the primary determinants of airport passenger distributions. However, actual passengers do not use computerized travel times for determining which airport best meets their travel needs. The use of only a few variables constituting basic multinomial logit formulations is simply not adequate to predict highly complex airport choice behavior, encompassing a much wider range of personal perceptions of airport, ground access, and air service attributes, as well as cultural, economic and personal values.

RADAM is a system-wide analytical tool that treats all of the airports in the regional system in a rigorous, consistent manner, using one overall methodology. By recognizing that airports compete for a total number of passengers, RADAM avoids the “double counting” of air passengers that can occur when demand is estimated for individual airports in isolation from, and with disregard for, competitive interactions with other airports in the system. It is much more realistic in terms of capturing complex airport choice behavior in multi-airport systems than simplistic and conventional “catchment basin” gravity models.

C. Capturing Human Behavior and Perception

A unique feature of the RADAM model is its adjustment of input values to account for human behavior and perception, as opposed to abstract and sterile computer-generated data. This adjustment is based on extensive (over 80,000) passenger surveys taken at all of the air carrier airports in the region, as well as Santa Barbara

Airport and Lindbergh Field in San Diego. Thousands of additional surveys from Germany, Japan, Poland, France and Mexico play a key role in the simulation process. Airport choice is driven primarily by perceptions of passengers. An allocation methodology that incorporates passenger perceptions insures not only greater accuracy, but also provides opportunities to test very subtle interactions in how different passenger groups respond to small incremental changes in a wide range of airport, flight and ground access attributes.

The accuracy of passenger perceptions is directly proportional to how frequently passengers fly, their access to appropriate information sources, as well the values they place on airport choice attributes such as flight frequency, air fares, ground access, parking, terminal congestion, etc. Perceptions of passengers who place strong emphasis on certain attributes such as air fares or flight frequencies are usually more accurate as compared to passengers who have less defined requirements and select airport in a more abstract fashion. The most accurate perceptions, particularly with regard to flight frequencies, schedules or non-stop destinations, are those of frequently flying domestic business passengers. The least accurate perceptions are often those of international passengers traveling on all-inclusive tours.

D. Asymmetric Logic

In the survey process, it was found that passengers do not examine their airport choice options in any strictly comprehensive, informed or objective way. Instead, they more often make these determinations lacking full information about airport attributes, based on habit, airline loyalty, advertising and promotions, recommendations from travel agents, and a host of other general impressions and preconceptions. Many of these passengers, particularly those not familiar with the region, are more likely to choose large hub airports over smaller ones, on the assumption that larger airports are more likely to be convenient to access and competitive in price.

Some of these passengers do not use any sort of normative criteria in responding to surveys, and show strong inconsistencies. For instance, a passenger who chooses airfare as the most import airport choice criterion may also reveal in the same survey as having chosen a sub-optimal airport or flight in terms of airfare. Surveys with these kinds of inconsistencies (up to 25%) would have to be rejected by conventional statistical models. However, they may well contain valuable information if the objective is to fully incorporate the imperfect human process of decision making with all of its inconsistencies and contradictions. The RADAM methodology captures this information with the use of Asymmetric Logic, which is a method used to mathematically incorporate anomalous survey data in the modeling process, in order to reflect idiosyncratic human behavior. The data is therefore rendered more precise and realistic before being fed into the model, since it includes important information on anomalous airport choice behavior that would otherwise have been filtered out as noise or error.

E. Interactive Service Areas

Another unique feature of the RADAM methodology is its use of interactive airport service areas. Although usually adequate for describing single airport systems, the term “catchment area” loses its validity in multiple airport systems such as that found in Southern California. In a single airport system, the service area of an airport is exclusive and subject to the character, intensity and distribution of local demographics. However, in a multiple airport system, individual airports do not have exclusive or fixed service areas that can be defined as, for example, county boundaries, 40-minute travel time contours, or 30-mile circles around airports.

In multiple airport systems, several airports share an interactive and highly dynamic regional passenger market with overlapping service areas. Different service areas apply to different flight and passenger categories. For example, the service area for commute passengers in Ventura County concentrates around Oxnard Airport, while the service area for LAX international passengers covers a region extending from a far north as Fresno and as far south as Mexico. Consequently, the international service area of LAX overlaps its own short-, medium- and long-haul service areas as well as the service areas of all of the other airports in the region, which comprise the largest aviation system in the world in terms of both number of airports and aircraft operations.

Service areas are not simply driven by geography, such as driving distance to an airport, but are also a function of a variety of airport, ground access and flight cost and service attributes. Since these vary considerably from airport to airport, passengers from a single area will allocate differentially among alternative airports. The greater the number of airports and diversity of available air service, the more complex and interactive the allocation process.

In some cases, the sensitivity of certain passengers to airfare can override other considerations such as convenience or airport access time. For example, RADAM modeling of Ontario Airport showed a tangible market for flights to Latin American destinations in the demand generation process. However, the subsequent allocation process showed that these passengers have such a high sensitivity to air fare that most (69.8%) would travel up to an additional 3 hours to an alternative airport (such as Tijuana) to realize a savings of $45 or more. Conversely, passengers at John Wayne Airport (mostly business) have shown a high tolerance for the relatively high airfares at that airport (about 28% over the average), although passengers at John Wayne decreased slightly last year, which indicates a diversion of passengers to more distant airports. This shows the highly dynamic and interactive nature of passenger distributions in such a diverse multi-airport system as ours, which the RADAM model is uniquely capable of assessing.

F. Demand Generation Process

The RADAM methodology generates current and forecast air passenger demand for 100 RADAM aviation zones in the region (see Figure 1), as well as additional zones in the Coachella Valley and San Diego County. For current demand, available airport origin-and-destination (O&D) data is used. Correlations between this data and the latest socioeconomic census data are drawn through a series of sequentially cascading MNL equations to estimate the magnitude and characteristics of air passenger demand for those portions of the region with incomplete O&D data. For forecast demand, the correlated data are applied to SCAG's forecast socioeconomic data for each RADAM zone. The following socioeconomic factors are the primary ones used in the correlation process:

- Total Population
- Population over 65
- Total employment
- Retail employment
- High-tech employment
- Median household income
- Databases on travel expenditures
- Databases on propensities to travel
- Household size
- Number of households
- Licensed drivers per household
- Single dwelling units
- Multiple dwelling units
- Special generators (major tourist and/or business attractors)
- Direct and indirect airport employees
- Various income categories

A distinguishing feature of the RADAM demand generation methodology is that, unlike macro demand models, it does not simply split a regional demand total into fractions for allocation to individual airports. It instead takes a micro model approach by generating passenger demand from the ground up, one RADAM zone at a time. In this way, the socioeconomic differences between different subregions that influence the creation if air travel demand can be specifically reflected in the demand generation process.

The demand generation process includes the calculation of "induced" and "catalytic" demand. Induced demand represents the increased propensity to fly (over baseline conditions) due to the more convenient provision of airport services to existing populations, such as when a nearby military air base is converted to commercial use, or when an airport adds more frequent and/or less expensive flights. The inclusion of catalytic demand quantifies the phenomenon of new businesses and employees being attracted to the vicinity of new or expanding airports with development opportunities around them in the form of relatively inexpensive, developable land.

These businesses are typically airport-dependent or airport-related, and desire proximity to airports as a way to reduce their overall costs since their employees fly much greater than the average, and/or they produce goods that are disproportionately transported by air. The location of these types of businesses around airports increases aviation demand in nearby zones. The catalytic demand function is based on empirical observations of passenger demand at new or expanding airports, as well as an analysis of the availability of developable land around airports. Because of the addition of induced and catalytic demand to baseline demand, the regional demand total is a variable that depends on the amount and distribution of airport capacity and quality of service around the region, and is not a fixed and independent parameter.

It should be noted that traditional methodologies for generating regional passenger demand typically employ regressions of population, employment, per capita income and airline yield data, and are based on extrapolations of historical growth trends in combination with assumptions about the future. They can be satisfactory for generating “ball park” future demand estimates, and have some merit when applied to largely homogeneous markets served by a single, large airport that is growing at a fairly predictable rate. However, the RADAM methodology is a much more rigorous, accurate and defensible analytical tool for generating and allocating demand in complex and diverse regional airport systems served by multiple, competing airports.

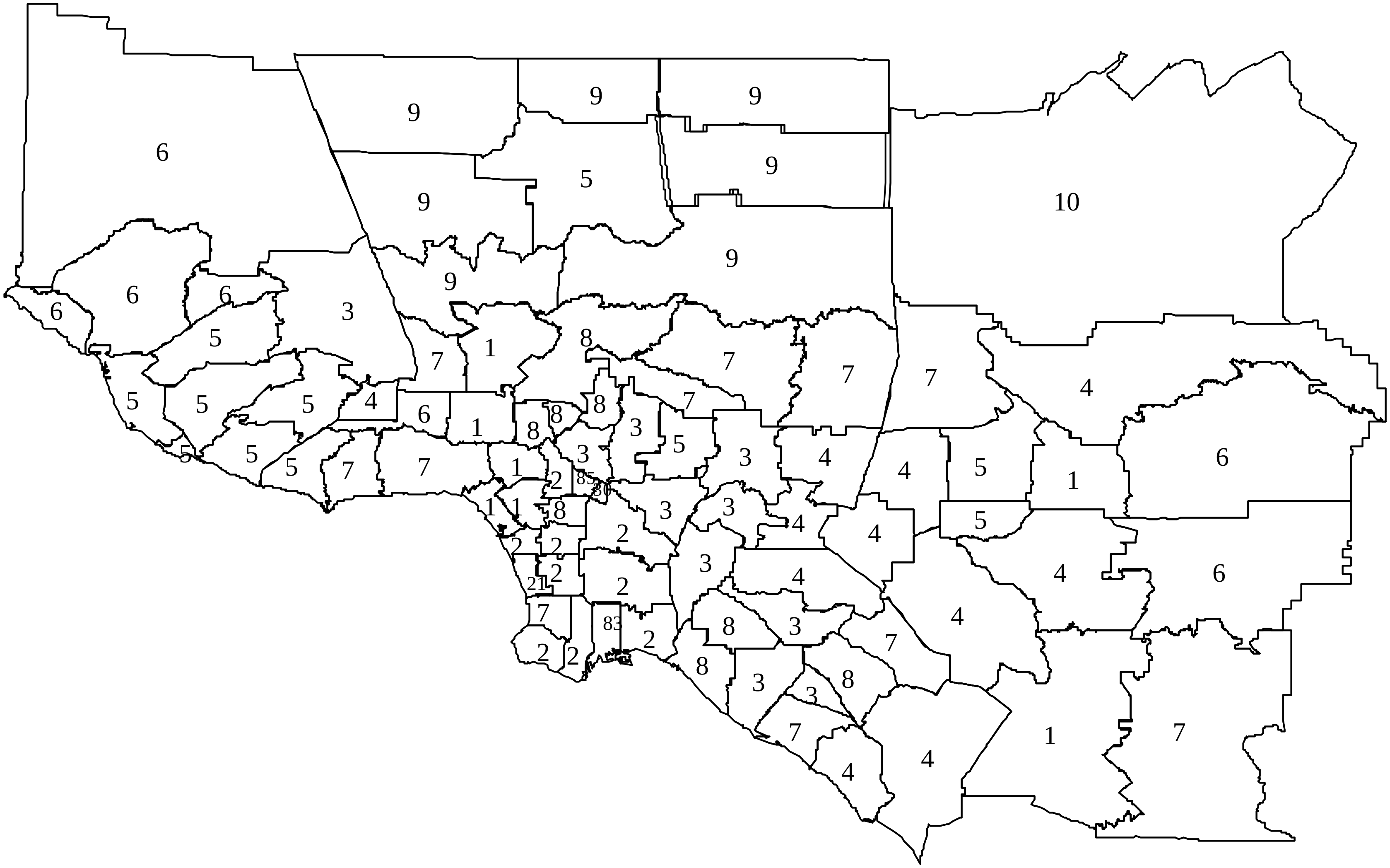
G. Airport Choice Variables

The survey process identified a number of variables that most influence the airport choices of air passengers. These variables were calibrated for different categories of air passengers using a sophisticated curve fit program. The categories of passengers (not mutually exclusive) include short-, medium- and long-haul passengers, international passengers (with subsets of Pacific Rim, Europe, Latin America, and Canada/Mexico passengers), and business, pleasure and exclusive tour passengers. The primary airport choice variables that are calibrated by the RADAM model for the various passenger groups noted include:

- Total Number of Flights
- Frequency of Flights
- Non-stop Destinations Served
- Number of Discount Airlines
- Databases of passenger choice behavior
- Databases of historical airport choices of passengers
- Travel Time from Home
- Travel Time from Work
- Travel Time from Hotel/convention Center
- Ground Access Congestion

SCAG RADAM Zones

Figure 1



- Various categories, and subcategories of air fares
- Terminal Congestion and Convenience
- Number of Gates/Gate Saturation
- Parking Costs and Convenience
- Parking Saturation
- Central Terminal Area Congestion
- Curbside Congestion
- Airport Mode Choice Options

Most of these primary choice variables are comprised of smaller support modules with additional subvariables. As previously noted, calibration of many of these parameters involves adjustment to account for human perception. For example, modeled travel times are adjusted according to actual travel times measured through field surveys, as well as the perception of travel times from different zones to airports as indicated by the passenger surveys. The calibration process also recognizes that different classes of passengers use different sets of criteria, or give different weights to the same criteria. Also, passengers may not use the same set of criteria in assessing the attractiveness of different airports, or may weigh criteria differently from one airport to another. Calibrations for the different categories of passengers are also refined for different parts of the region. For example, business passengers are generally more time sensitive than non-business passengers, and are less willing to travel farther to catch a long-haul flight. This difference is more pronounced in areas with a high percentage of very affluent business passengers.

The last step in the RADAM calibration or weighting process is to determine the cross-elasticities between the variables. In short, this means replicating how the different passenger groups make implicit tradeoffs between the choice criteria in deciding which airport to choose. For example, a short-haul passenger who is sensitive to travel time will continue to choose a convenient local airport, unless rising airfares reach an unacceptable threshold and prompts him to select more distant alternatives. Alternatively, a business passenger who typically chooses a large airport because of high flight frequencies and flight availability may be induced to consider flight options at smaller, uncongested airports because of rising terminal and parking congestion at the large airport that exceeds his tolerance threshold.

H. Demand Allocation Process

In general, the RADAM demand allocation process is based on a process of matching major airport attributes (available flights, air fares, parking congestion, ground travel time, etc.) with the primary airport choice factors identified and calibrated for the different passenger categories in each RADAM zone. The number of air passengers that are allocated to a particular airport from a particular zone is determined by how many of those passengers have their travel needs best met by the particular set of attributes at that airport. A series of MNL equations evaluate a myriad of airport attributes and airport choice factors to calculate the degree of matching for each of the millions of passengers in the database. This is typically done through a series of 6-14 iterations for each alternative evaluated in the regional context. The result is a percentage allocation of passengers from each passenger category in each zone to each existing or hypothetical airport, producing a total passenger allocation to each airport.

Since the RADAM allocation methodology is not based on exclusive service areas or “catchment basins” for individual airports, which are usually arbitrarily defined, a single RADAM zone can have passengers that are distributed to several airports. In fact, there are multiple zones in the region that generate passengers to all five urban air carrier airports.

After the first iteration, typical fleet mixes and passenger load factors are drawn into the analysis for each haul type, and flight frequencies are adjusted to be consistent with different combinations of demand, aircraft capacity and load factors. During the last iteration, the number of flights is adjusted until load factors do not decrease below a set percentage that is considered to be consistent with what is economically acceptable (i.e. 60 percent load factor). Generally speaking, the iterations continue until only minor changes occur, and a point of equilibrium or homeostasis is reached for each of the millions of passenger matches with all the airport and airline service attributes.

The iteration process replicates how the entire regional airport system adjusts to significant changes, such as the addition of a major new airport that diverts passengers from other existing airports. This diversion of passengers in turn makes those airports more desirable for certain passengers because they are less congested, which is reflected in subsequent iterations through a partial return of lost passengers back to those airports. RADAM computer simulations offer the advantage of taking place in “real time” that is much quicker than the actual lag time required for adjustments in human behavior to be made.

I. Limitations of the RADAM Model

The RADAM methodology can produce highly accurate estimates of air passenger and cargo demand potential of airport capacity expansion projects, including new airports. However, its primary limitation is that it cannot absolutely predict the willingness of carriers to invest in the facilities and services needed to exploit that demand. Over the last decade the major carriers have consolidated their flights in large markets, and have been reluctant to pursue smaller markets, even growing new ones. It is important to note that in testing the demand potential of new airports, input assumptions were made that new flights will be initiated at those airports, which in the real world may not actually occur. However, it is also important to recognize that in assigning flight portfolios to airports, the RADAM methodology references empirical studies of airline behavior that have observed how airlines typically invest in airport services. This includes the number, variety and stratification of flights that are provided (first commuters and short haul then medium haul and higher echelon flights) given the level and type of demand airports are able to attract. For example, airports are typically highly reluctant to invest in long haul and international flights at airports with relatively low demand attracting potential, such as suburban airports that are distant from major population and employment centers. However, due to its flexibility, RADAM has also been employed in simulations of constrained airport systems, which assume that flights would be brokered between several airlines to initiate new service at outlying airports, not necessarily following the conventional flight service stratification. Thus, some outlying airports can have medium and long-haul flights sooner than has been observed historically in totally unconstrained airport systems.

An essential source of data that is input to the RADAM model is the forecast of regional passenger propensities to fly and passenger travel histories in addition to socio-economic and perceived traffic conditions. While developed in a rigorous fashion by SCAG, there is always an element of uncertainty involved with predicting the extent, location and character of population, employment and traffic growth twenty or thirty years into the future.

J. Special Features of the RADAM Model

- High-Speed Rail Module—This design feature of RADAM has been used to test various hypothetical high-speed rail (HSR) alignments (as well as different HSR speeds, capacities, schedules and fares) for their ability to shift air passenger demand among airports. For the 2004 Aviation System/RTP study, HSR was tested for its ability to strengthen potential demand at smaller suburban airports, including establishing a wider range of flight offerings at those airports, and to minimize regional air pollution impacts. Various configurations of regional air passenger demand were also tested to determine the degree to which airports can help spur passenger demand for HSR. The RADAM HSR module is calibrated based on 60,000 passenger surveys conducted in Southern California, as well as surveys conducted in Europe on the French TGV system and the German ICE system, in addition to surveys of the Japanese Bullet Trains. The most commonly used calibration is based on the French TGV surveys normalized for Southern California passengers. This calibration is relies on the operational characteristics of TGV passengers, but the ridership and preferences in terms of mode choice, fares, etc. are based on surveys collected in the SCAG Region.

- Ground Access Analysis—For each airport system scenario evaluated, the RADAM model estimates how many passengers originate from each subregional RADAM zones, and distributes them to airports. It can also assign passengers to major routes from each RADAM zone to each airport according to routes identified by passengers in the passenger surveys as the ones they typically take to airports. Hence, the RADAM methodology is uniquely capable of generating the necessary data for assessing both individual airport and system-wide airport ground access impacts associated with different scenario. Data can include air passenger and truck trip assignments by mode, and regional or airport-specific vehicle-miles-traveled (VMT). The potential effect of various major ground access improvements to airports can also be tested for their impact on passenger and cargo distributions between airports, by including them in the modeled scenarios. Such improvements could include new freeways, major capacity enhancements, light rail lines, HOV lanes, and future ground access technologies including intelligent transportation systems (ITS). VMT associated with airport employment can also be calculated. Using VMT data generated by RADAM, airport ground access air emissions can be estimated in conjunction with the DTIM emissions model. This information can be a key factor in air quality conformity analyses, which typically assess airports individually and apart from a complete regional systems context.

- Airport Employment Generation and Distribution—As previous described, the RADAM methodology estimates catalytic employment associated with development and employees attracted to new or expanding airports. For instance, in a previous study it was estimated that March AFB would attract about 39,000 new jobs if converted to a 3.0 million annual air passenger (MAP) airport. The model also has a function that can distribute these jobs (as well as direct and indirect jobs associated with the airport) based upon trip length frequency/distribution curves for different airport employment categories that were formulated from survey data taken at a number of different airports in the region. Current and future housing availability in nearby RADAM zones is also considered, based on current housing density and amount of developable land that is available for future housing.

- Air Cargo Model—A RADAM air cargo demand generation, forecasting and allocation model has been developed and calibrated to complement the RADAM air passenger model, with which it is fully integrated. This "bottoms up" cargo model is a significant improvement to the "top down" methodology that was previously used by SCAG aviation staff in regional air cargo and military air base studies it conducted in the 1990s. Generally speaking, air cargo demand is generated by RADAM zone for different categories of cargo (i.e., domestic, international, mail, express and non-express cargo) based on measured and surveyed air cargo generation rates for different employment categories and industry types. Cargo is allocated from each RADAM zone to each airport based on number and types of aircraft operations at each airport, ground access times, and location of or availability of land for warehousing/consolidation centers. A more complete description of the RADAM air cargo model can be found in the following section.

MODELING AIR CARGO ALLOCATIONS FOR THE 2004 RTP

A Discussion Paper for the SCAG Aviation Task Force RADAM Model Workshop

(Updated 10/16/03)

I. Introduction

Prior to SCAG's 2001 aviation system study, the Regional Airport Demand Allocation (RADAM) model was used to generate and allocate just air passenger demand. Air cargo handling potential was estimated using a much less sophisticated "top down" methodology that assessed county shares of the regional demand total based upon Los Angeles Customs District and County Business Pattern commodity and employment data. This unique methodology developed by SCAG staff was able to identify subregional cargo handling shortfalls such as in Orange County, which produces about 30% of the region's total cargo volume but handles less than 2% of that total. However, the methodology was unable to precisely allocate cargo to individual airports based on where cargo is produced and distributed in conjunction with measurements of airport attributes that are important in attracting and distributing air cargo. The RADAM air cargo model that was first employed in the 2001 system study is capable of doing this since it is a "bottoms up" model with an architecture similar to the RADAM air passenger model. It is a vast improvement over previous cargo methodologies used by SCAG and fully complements RADAM capabilities in air passenger simulation.

It needs to be recognized, however, that transporting cargo is very different than transporting passengers. The behavioral aspect of the model is more indirect since what is being transported does not participate in the airport decision-making process. The RADAM air cargo model is based on thousands of domestic and international surveys taken at employment sites and airports. Consequently, it reflects the decisions made by company managers (i.e., shippers) and consolidators concerning which freight forwarders and/or carriers will handle their goods, and those made by freight industry managers concerning which airports they will direct their cargo to. This is a more dynamic and volatile environment than the air passenger industry since it depends less on the aggregate behavior of millions of consumers, and more on business and contractual relationships among major industry stakeholders that are constantly evolving in a highly competitive market.

A. Recent Trends in the Air Cargo Industry

Recent examples of the dynamism of the air cargo industry abound. After airline deregulation in 1978, the door-to-door "integrated" cargo carriers such as FedEx and UPS that operate their own all-cargo freighter aircraft quickly came to dominate the domestic air cargo market. They are increasingly making inroads in the international market as well, which is a primary reason why the majority of the region's cargo is now transported in all-cargo aircraft. There has also been a marked blurring between the traditional categories of freight forwarders, all-cargo carriers, passenger/cargo combination carriers, charter carriers and cargo truckers. In fact, much of what is "sold" as 2nd- or 3rd-day air cargo never sees the inside of an airplane and is transported by truck or train in a tightly-coordinated "time-definite" fashion. Recently, increasing amount of express cargo now is transported by truck. In combination with the increase use of FAX and e-mail to send documents, this has significantly dampened forecast growth rates for overnight and second-day express air cargo.

The integrated air cargo operators are also increasingly providing data-intensive, value-added logistics services including supply chain management, inventory control, multimodal delivery services, cost control, and in some cases assembly and labeling. For many shippers, particularly those that extensively rely upon just-in-time (JIT) delivery of component parts and final products, moving information has become as important as moving cargo. Heavy investments in high-tech information management systems have become essential to serve these needs. The rapidly increased specialization of the air cargo industry is making it difficult for the passenger airlines, which specialize in moving passengers, to compete with the cargo carriers, even with relatively inexpensive belly capacity. The passenger carriers are wedded to airline schedules, and belly capacity increases in proportion to growth in passenger demand, which is being outstripped by demand for air cargo services.

Another marked trend in the industry has been an increasing shift of air cargo carried in the belly holds of passenger aircraft to dedicated all-cargo freighter aircraft. Before deregulation of the airline industry in 1978, cargo carried by all-cargo freighters was 20% or less of total air cargo. It is now over 70%. Table 1 below shows the results of air cargo data that SCAG has collected from all six air carrier airports in the region. It shows that since 1994, the percentage of air cargo carried by dedicated all-cargo freighters at SCAG Region airports has increased from 59% to 71% of total air cargo.

This shift can be attributed to a number of different factors. The major reason is that the passenger carrier have had a hard time matching the efficiencies of the all-cargo carriers, particularly the integrated operators like FedEx and UPS that provide operate their own trucks and airplanes and provide door-to-door service. Efficiencies in the all-cargo industry include hub-and-spoke systems that are tightly coordinated, sophisticated ground pick up and delivery systems, and computerized package sorting and shipment tracking systems. The all-cargo carriers are also increasing incorporating computerized logistics systems to provide integrated and customized supply management and inventory control services to their clients. The passenger carriers have been hard-pressed to keep pace with the advances made by the all-cargo carriers, particularly the integrated operators. The passenger carriers have also been hindered by the fact that they specialize in carrying passengers, not cargo, and are inherently limited in the number of origin-destination market they can serve, and the number of nighttime operations they can provide. As discussed below, the impacts of the events of September 11, 2001 accelerated the advantages that all-cargo carrier have over the passenger airlines in transporting air cargo. The ever-increasing shift of air cargo from passenger planes to dedicated all-cargo aircraft argues that all-cargo airports are much more feasible than fifteen or twenty years ago. It is now possible to substantially separate cargo from passenger traffic, since having available belly capacity is no longer a prerequisite for handling air cargo. This can be strategically desirable, such as in relieving capacity-constrained passenger airports by diverting much of their all-cargo activity to all-cargo facilities with available capacity. In fact, the SCAG Region is an excellent example of a region that has severely capacity-constrained urban airports, but abundant available capacity at suburban airports that can serve in the all-cargo mode.

Figure 1

Dedicated Vs. Belly Cargo at Air Carrier Airports in the SCAG Region

		1994		**2000**		**2002**	
		Tons	%	Tons	%	Tons	%
LAX	Dedicated	783,585	46%	1,173,947	60%	1,224,182	62%
	Belly	919,860	54%	782,631	40%	747,144	38%
ONT	Dedicated	353,317	93%	448,902	97%	538,069	98%
	Belly	26,593	7%	13,884	3%	9,391	2%
LGB	Dedicated	27,454	99%	51,483	99%	58,531	>99%
	Belly	277	1%	520	1%	75	<1%
BUR	Dedicated	24,801	80%	29,629	95%	40,815	95%
	Belly	6,200	20%	7,407	5%	2,274	5%
JWA	Dedicated	12,360	78%	13,770	76%	13,312	85%
	Belly	3,418	22%	4,349	24%	2,334	15%
PSP	Dedicated	0	0%	0	0%	0	0%
	Belly	297	100%	144	100%	82	100%
TOTAL	Dedicated	1,201,517	**59%**	1,717,731	**68%**	1,874,909	**71%**
	Belly	956,645	**41%**	808,461	**32%**	761,300	**29%**
	Combined	2,158,162		2,524,692		2,636,209	

B. SCAG March AFB Study

For these and other reasons, SCAG aviation staff have argued that there is potential to convert one or more of the region's recently closed or downsized military air bases into an all-cargo airport specializing in handling just air cargo. In its 1997 March AFB Joint Use Feasibility Study, a case study approach reviewed the success of all-cargo airports in the country. The study concluded that March has the potential to serve as an intermodal all-cargo airport and distribution center, similar to the first successful all-cargo airport in the country, which is Rickenbacker Airport in Columbus, Ohio. There are a number of other successful all-cargo airports in the country that have emerged over the last five years, including Alliance Airport in Texas, Willow Run Airport in Detroit, and Mather Airport in Sacramento. A more in-depth description of these airports can be found in the following section, which presents a case study analysis of all-cargo airports around the country.

C. Factors Opposing the Development of All-cargo Airports

Despite emerging trends that increasingly favor the all-cargo airport concept, there is a substantial amount of inertia and a number of opposing factors to overcome. Although the integrated all-cargo carriers are making increased penetration into the international air freight market, most international air cargo is forecast to be continued to be carried by international passenger carriers. This is because the international carriers fly to distant foreign countries on a regular basis and the their large aircraft typically have abundant available belly capacity for cargo. The international passenger carriers are clustered at large international gateway airports where there is an extensive network of forwarders, consolidators and customs brokers to serve them, which also attract the non-integrated all cargo carriers that rely on these services. In this region, the majority of international freight forwarders and customs brokers value their proximity to LAX since they are also close to the ports and have the option of sending less time-sensitive cargo by ship if they choose. Further, many of the all-cargo freighters at LAX are operated by foreign passenger carriers such as JAL and KAL (which is an increasing trend that is spreading to U.S. carriers as well). They could be loath to split their cargo operations from their passenger operations since they frequently shift freighter cargo to belly cargo depending on the availability of capacity. Even some of the integrated cargo carriers that operate for the most part independently from freight forwarders, consolidators, brokers and passenger carriers prefer having passenger belly capacity available to them for emergency situations. For example, when truck deliveries fail arrive at airports on time to load aircraft because of highway congestion, some integrated operators shift their cargo to passenger carriers in order to meet delivery schedules, even when it entails a financial loss.

D. Impacts of the Events of September 11

However, many of the factors that hinder the development of all-cargo airports were substantially eroded after the events of September 11, 2001 (9/11). Immediately following 9/11, freight and mail were banned from the belly compartments of passenger flights for several days. This diverted cargo from passenger planes to the all-cargo integrated and charter operators, and also to ground modes (i.e., truck and rail) and the ocean mode for international cargo. This requirement was soon lifted, but several passenger carriers imposed their own limits on cargo traffic, such as holding shipments for 24 hours and turning away potentially dangerous goods. Recently issued Federal regulations have increased inspection and x-ray requirements for cargo loaded on passenger aircraft and have banned priority mail shipments on passenger planes weighing more than 16 ounces. They also tightened the "known shipper" requirements that were enacted after the crash of TWA flight 800 in 1996. These rules currently allow cargo from "known shippers" that have established a relationship (including a payment/credit history) with a freight forwarder or carrier to go on passenger planes unchecked. "Unknown shippers " though must produce two forms of identification that are kept on file until their cargo is delivered, and may not be told which flight their cargo may be transported on. Airlines now are also required to visit shippers to validate their identity if they are “unknown.” There are proposals currently being discussed in Congress for the TSA to physically inspect all cargo before being loaded on passenger planes. This could include putting such cargo through bomb detection machinery and/or placing freight in a decompression chamber for 24 hours, a requirement that is in force in several countries. Such procedures could significantly slow the processing of cargo loaded on passenger flights and throw supply chain logistics into disarray.

Several airlines and cargo carriers have recently imposed security surcharges on cargo to cover increased insurance, security and inspection costs. New and more stringent security requirements and procedures that are expected in the near future will further increase costs and processing times for cargo. Despite the recent economic downturn, the all-cargo integrated and charter operators are handling more cargo because of the more stringent inspection requirements, and the cutback on passenger flights and resultant decline in available belly capacity. Additional security requirements and procedures will likely accelerate the shift of cargo from the passenger carriers to all-cargo aircraft, as well as alternate modes of transport. This could further damage the financial condition of the airlines, since many of them rely on transporting cargo to boost profits (or minimize their financial losses).

Since 9/11, there has also been a significant reduction of passenger belly capacity that is available for carrying air cargo. In response to reduced passenger demand, most carriers have cut back on flights, and many have substituted smaller aircraft such as regional jets for larger aircraft such as B-737s and MD-80s on routes that have seen drops in demand. The reduced belly capacity has further accelerated the shift of cargo to dedicated all-cargo freighters.

E. Regional Imbalances in Air Cargo Handling Capacity

An ongoing air cargo problem in the SCAG Region that has recently been exacerbated is a regional imbalance between where air cargo is produced and where it is trucked for loading on aircraft. This imbalance is particularly acute in Orange County, and farther south in San Diego County. It is estimated that Orange County produces about 30% of air cargo that the region generates. This estimate was made in SCAG’s 1997 March Air Force Base Joint Use Feasibility Study, which employed a methodology that compared the top airborne commodities reported by the Los Angeles Customs District in 1994 with the employment each county generated in 1994 in each of those commodity groups. In 2003 the region’s airports handled 2.71 million tons of air cargo. Assuming that 80% of this amount was produced in the region, and applying the 30% factor for Orange County, results in an estimate of about 650,000 tons of air cargo currently being generated (either produced or consumed) by Orange County.

In 2003, John Wayne Airport, Orange County's only air carrier airport, handled 15,400 tons of air cargo. This is only 2.4% of the cargo that Orange is estimated to produce. John Wayne handles little belly cargo because of its weight restrictions imposed by its short 6700-foot runway; 85% of its cargo it handles by its two dedicated cargo departures per day. The airport's new settlement agreement allows for a doubling of air cargo flights, and increases allowable passenger levels to 10.8 MAP, and increase of 26.5% over the 8.54 MAP the airport served in 2003. Applying these growth factors to the cargo split between belly dedicated cargo at the airport in 2003, produces a total of 29,100 tons of air cargo potentially allowed under the airports new Settlement Agreement. This is still only about 4.5% of the total air cargo currently generated by Orange County.

In 2003, San Diego International Airport (SAN) handled 125,157 tons of air cargo. The San Diego Association of Governments (SANDAG) has estimated that about 80% of San Diego's air cargo is "leaked" to other regions. SCAG has recently estimated that SCAG Region airports handle from 75% to 77% of cargo generated by San Diego County, that is "leaked" to this region because of the inability of SAN to handle San Diego cargo due to its capacity constraints. With SAN expected to reach its 19 MAP existing physical capacity within the next ten years, this percentage will increase in the future unless San Diego finds another air carrier airport to supplement or replace SAN.

Fortunately, the region has a number of new air carrier airports in the Inland Empire that can serve the growing air cargo needs of Orange and San Diego counties, including March Inland Port, San Bernardino International and Southern California Logistics airports. In its 2030 Preferred Aviation Plan, SCAG forecasts passenger service at all of these new airports. However, they may have to operate in the all-cargo mode in the interim, serving primarily 2nd and 3rd-day delivery cargo that can be trucked moderate distances to and from production sites. The challenge will be to provide the appropriate incentives for spurring the development of cargo service at these airports in the short term. Overcoming "chicken-or-the-egg" problems in attracting cargo carriers and freight forwarders, who tend to have a herd mentality and are typically loath to initiate service at new airports, will be a particular challenge.

F. Incentives for Spurring All-cargo Airport Development

The key to overcoming factors that inhibit the initiation of all-cargo airport development is to provide sufficient incentives to attract initial all-cargo service to a new airport. These incentives would be devoted to upgrading airports so that they could specialize in handling cargo quickly and efficiently, and specifically meet the needs of JIT manufacturers and distributors. They could include low landing fees and lease rates, on-airport warehousing, superior ground and airfield access, fiber optics and other high-tech information infrastructure, automated customs processing, and nearby intermodal facilities including truck and rail cargo transfer centers. The financing of such incentives could be problematic for new airports without a substantial current funding stream. Rickenbacker Airport, for example, did not become successful until after $80 million of public funding (local, state and federal) in critical infrastructure improvements was made (the facility has since attracted $287 million in private investment). The facility also enjoys inventory and real estate tax abatements, and other subsidies of about $3 million per year from local government. Finding and providing substantial public funding support to new all-cargo airports in this region as “seed money” to help them attract initial service, will be a substantial future challenge.

II. RADAM Air Cargo Model

A. General Structure

The RADAM version 4.2 multinomial logit (MNL) air cargo forecasting and allocation model is structurally very similar to the RADAM passenger model. Air cargo by category (i.e., express, general freight, and mail) is generated for each RADAM zone in the region based on the relative strength of socio-economic attributes (current and forecast) and historic air cargo growth trends. Travel distance to cargo-handling airports is also considered in the cargo generation phase. The second phase of the air cargo modeling process involves an allocation process in which air cargo generated for each zone is allocated to each of the competing airports in the system (existing and proposed) based on aircraft fleets, capacities, service portfolios, and ground access times to airports. Asymmetric logic is used to allocate air cargo that is not primarily driven by criteria that have been traditionally important in determining handling destinations, such as proximity to urban areas (i.e., travel time) and high flight frequencies. The use of asymmetric logic allows the methodology to incorporate such factors as contractual relationships between major shipper and carriers, and between carriers and airports. The allocations to airports are refined through an iteration process which continues until an equilibrium point is attained in which all airports achieve an optimal allocation of air cargo for each cargo category, including a balance between on-loaded and off-loaded cargo. The allocation of cargo for future conditions assumes that the air cargo industry is logistically and technologically capable of operating in the most efficient manner at each of the airports.

The RADAM air cargo model is much more capable of accurately assessing the cargo-handling potential of remote/satellite airports than other multinomial/probit or the older gravity models. Such models are inherently biased towards urban airports that are located closest to major air cargo commercial and industrial production centers. The incorporation of asymmetric logic in the RADAM cargo model, on the other hand, allows for the relative advantages of remote airports to be weighed in the allocation process, such as the availability of reasonably-priced land for warehousing and new distribution centers and intermodal transfer terminals. It also allows for incorporation of assumptions about future contractual relationships at potential new airports, such as substantial future e-commerce related cargo activity being steered to a particular facility by major carriers.

B. Cargo Generation Module

The RADAM air cargo generation module uses the following primary input parameters to generate current and forecast air cargo for each category by RADAM zone:

- Total population
- Population over 65
- Total Employment
- Retail Employment (by income level)
- Non-retail employment (by income level)
- High-tech employment
- Households
- Single dwelling units
- Population density
- Employment density
- Median income
- Truck/van travel times to cargo terminals at airports (urban and rural)
- Belly and all-cargo capacities at airports
- Cargo generation propensities by express, general freight and mail categories, based on thousands of survey data taken at employment sites and airports domestically and internationally
- International air cargo generation by foreign country economic activity (i.e., GNP, employment, income, etc.) and international passengers and air cargo activity at airports
- Databases of behavioral patterns in air cargo corporate environments

A wide variety of secondary inputs are also used especially for modeling of more complex airport system scenarios, such as those involving new airports, airport site selection and airport growth constraints.

Air cargo generation rates for different categories of air cargo are determined through use of airport cargo data in conjunction with data from surveys that were conducted of a large number of different entities involved in the shipping process including carriers, freight forwarders and brokers. Numerous manufacturers of air cargo commodities were also surveyed. In some cases, detailed data bases on cargo origins and destinations by cargo type were obtained. The survey information was correlated with regional socio-economic data as well as propensity databases by transportation analysis zone (TAZ) to develop cargo generation thousands of generation equations. A variety of surveys are employed to forecast air cargo based on different stratifications of origin and destination.

Like the RADAM air passenger model, the cargo generation model also has separate module that adds “catalytic” demand around new or expanding cargo-handling airports. This is additional demand that is generated by development (and its related employment and business activity) that is attracted to the vicinities of new or expanding airports. This catalytic effect is highest for potential new airports that RADAM modeling shows to have the greatest potential for attracting air passenger and air cargo demand, and have ample and reasonably priced land in their vicinities that is available for new development. These relationships are built into the model, based on empirical studies of how new airports stimulate nearby growth and development. Principal sources of information for the air cargo catalytic demand module parallel those of the RADAM passenger model. These include mathematical relationships between investment databases (i.e. financial loans) taken prior to new airport construction and airport growth in other areas of the U.S. The model can adjust the amount of catalytic demand induced around an airport based upon new information (financial databases) that is available from case studies that address an airport's unique circumstances.

Regional air cargo demand distributions that were generated for the 2001 RTP are displayed in figures 1 through 4. They show 2025 cargo by RADAM zone for total express, freight, and e-commerce cargo. The high concentrations of cargo generation activity shown in San Bernardino and Riverside counties in 2030 is primarily because of the large number of distribution centers forecast to locate around Ontario, San Bernardino International and March Inland Port airports.

C. Airport Allocation Module

The RADAM air cargo allocation module uses the following primary input parameters to allocate air cargo to exiting and potential future airports in the regional aviation system:

- Truck/van travel time to cargo terminals at airports (peak and off-peak)
- Airport flight portfolio (commuter, short-haul, medium-haul, long-haul, international)
- International flight portfolio by world region served
- Airport hours of operation
- Number of destinations served
- Domestic and international all-cargo operations
- Aircraft fleets and aggregate air cargo capacities
- Load factors for passenger (belly) and all-cargo aircraft
- Availability and cost of on- and off-airport compatible land uses (e.g., warehousing)
- Travel time from airports to intermodal cargo transfer centers
- Existing or potential contractual agreements (through asymmetric logic)

Dozens of additional secondary inputs are used in the air cargo model to more accurately process both the generation and allocation of cargo. For example, an airport attracting larger volumes of cargo reaches certain higher profitability thresholds (lower shipping costs and consolidation savings), which translates into an expansion of non-stop destinations, expanded hours and increased flight frequencies. These advantages along with lowered costs generate more air cargo either as new cargo or by diverting cargo from ground transport modes.

Besides contractual agreements, the use of asymmetrical logic is used to incorporate such non-traditional modeling factors as hours of airport operation, cost of warehousing, cost of office park or industrial park space, proximity to air cargo terminals, and proximity to low wage labor force. It is also utilized to incorporate anomalous or non-traditional responses to factors such as flight frequencies or proximity to urban areas in the weighting of those factors for certain companies.

Figure 1

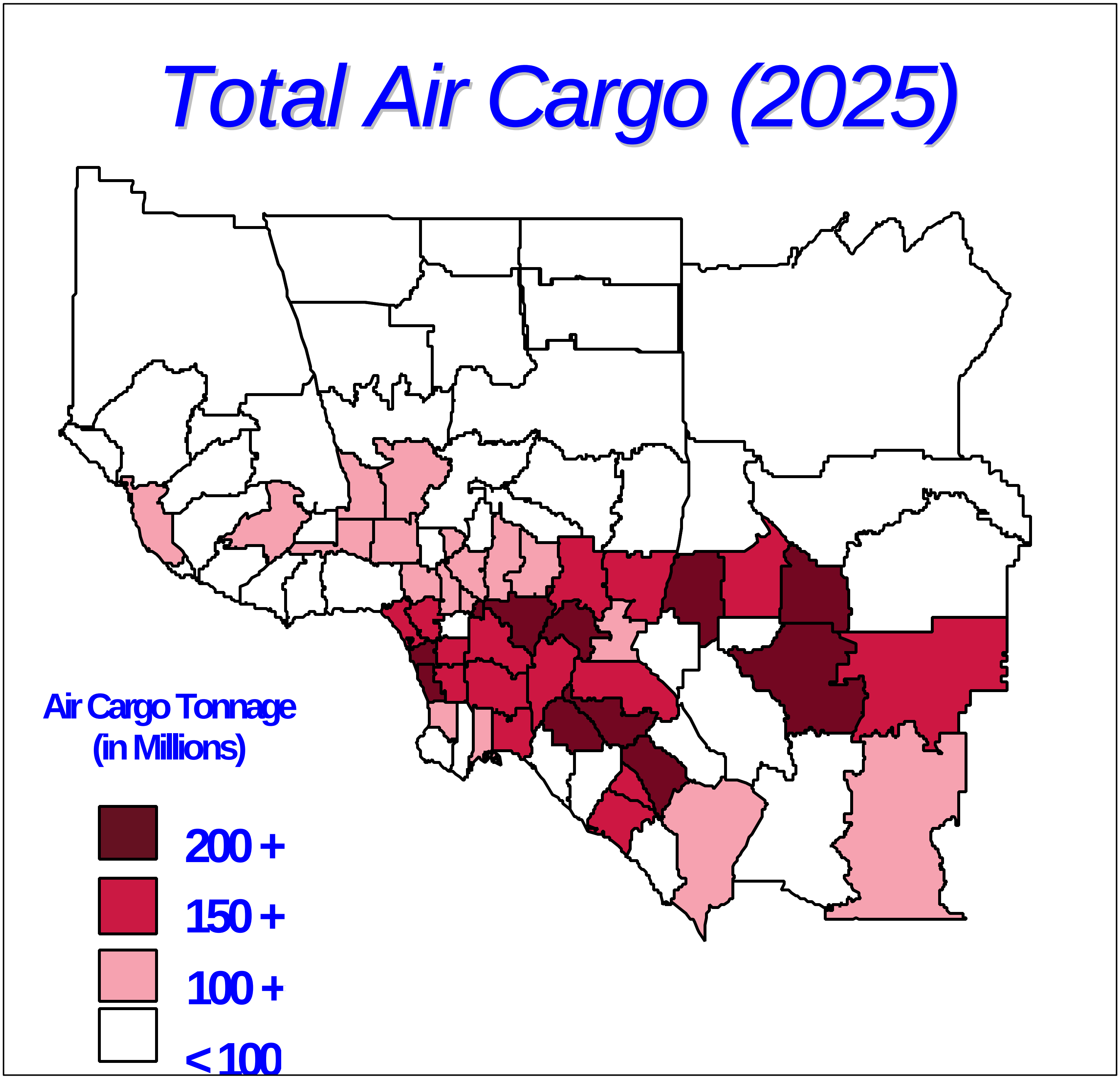

Total Air Cargo (2025)
Air Cargo Tonnage
(in Millions)
200 +
150 +
100 +
< 100

Figure 2

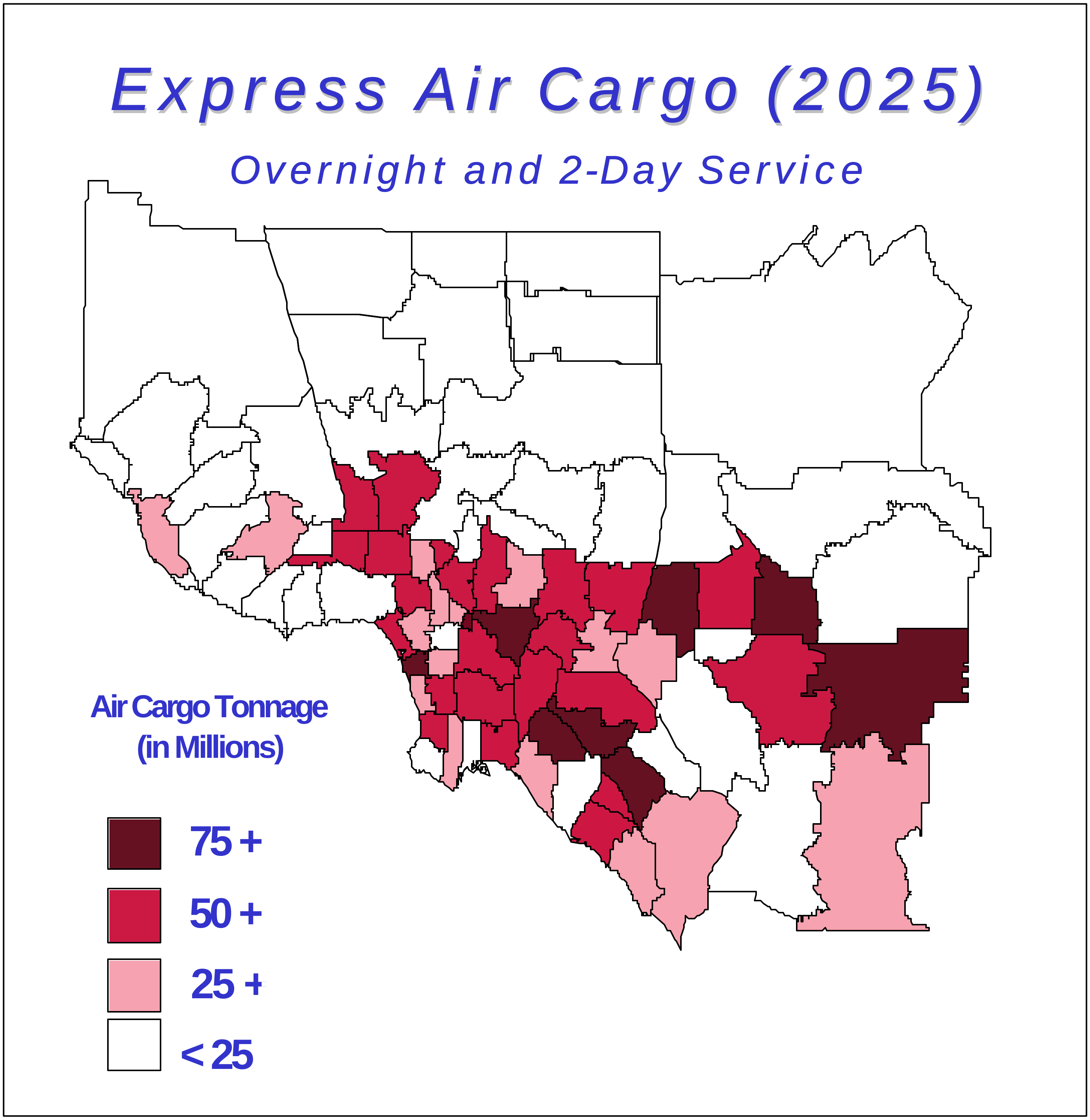

Express Air Cargo (2025)
Overnight and 2-Day Service
Air Cargo Tonnage
(in Millions)
75 +
50 +
25 +
< 25

Figure 3

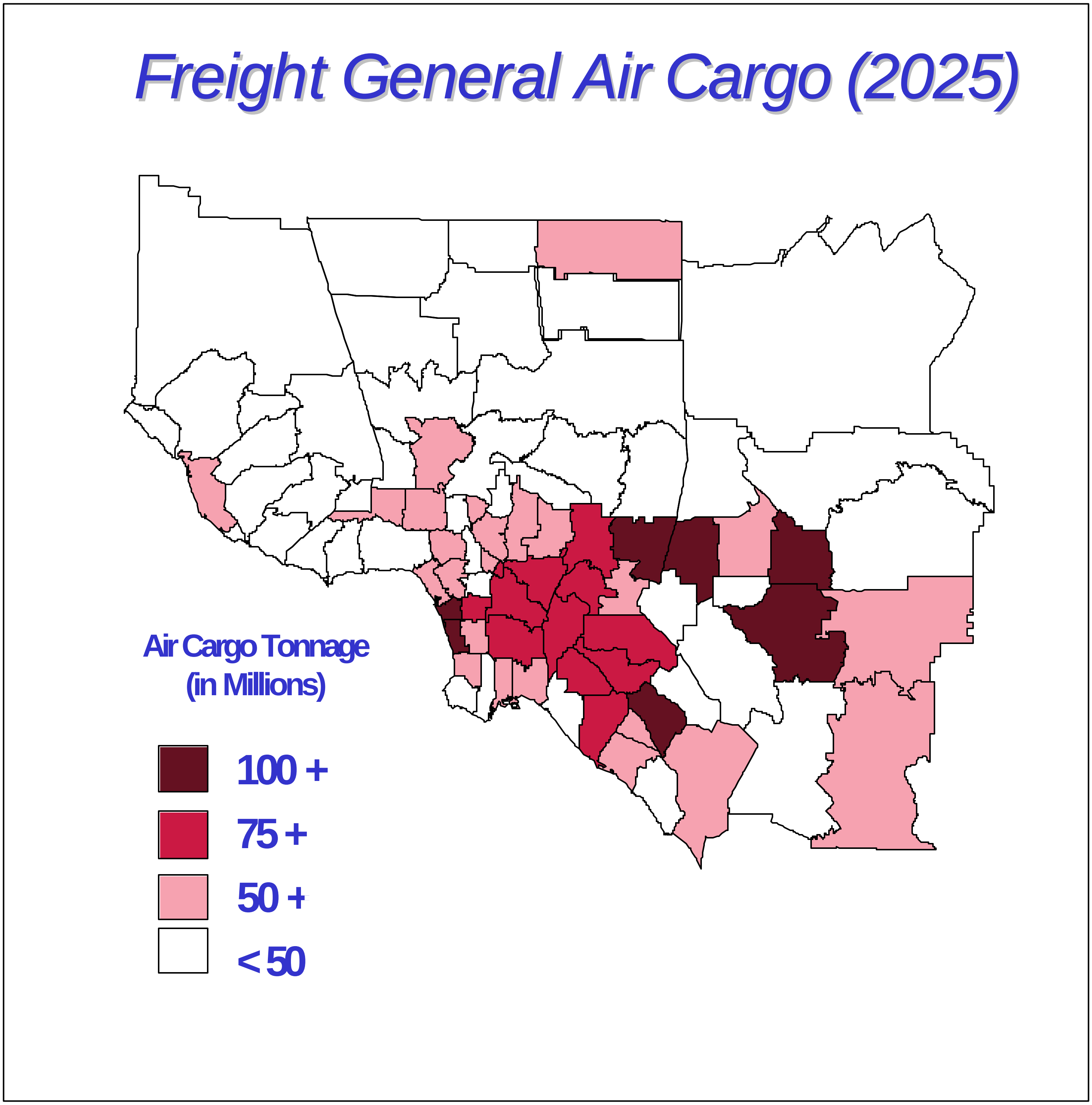
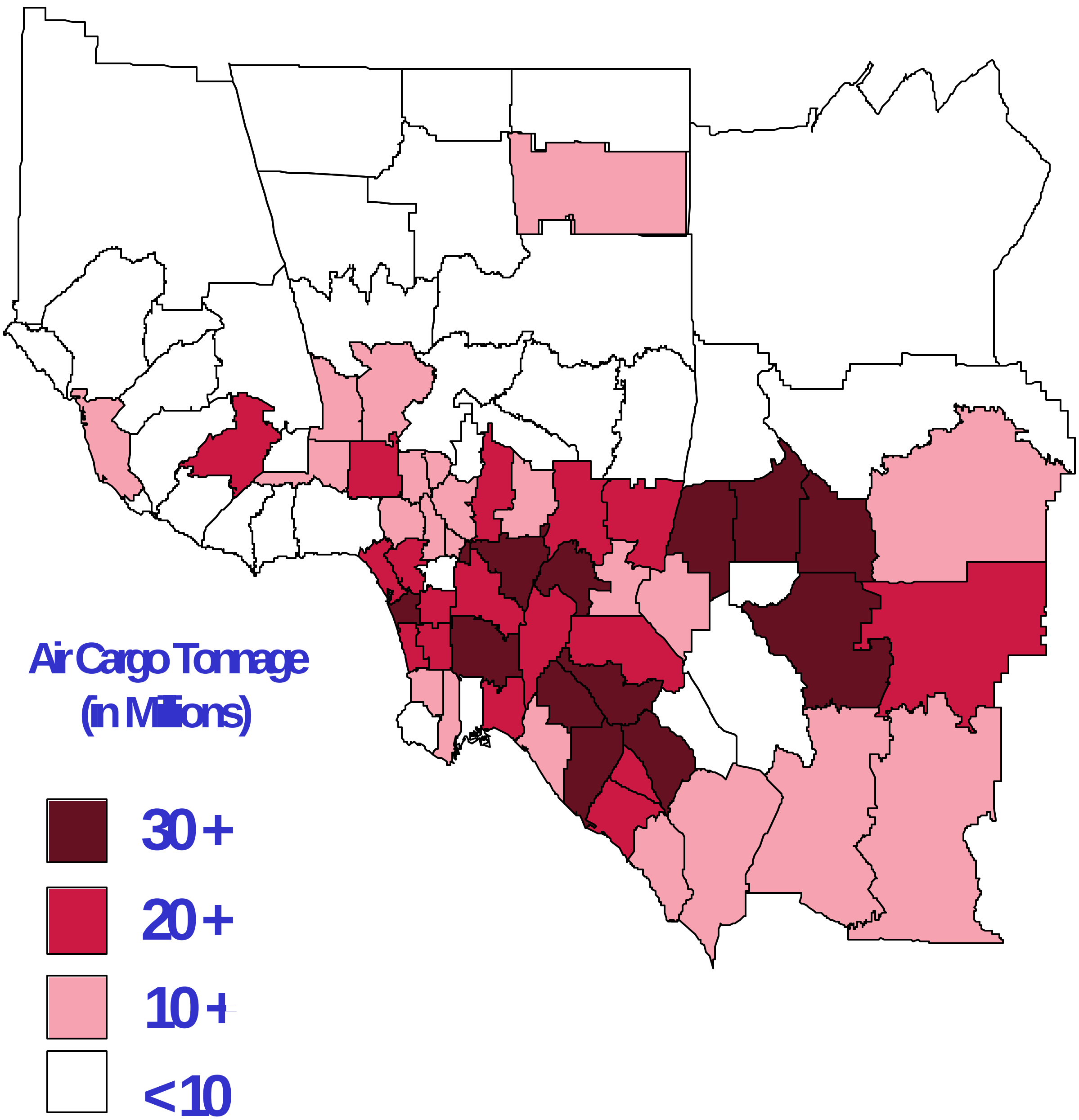

Freight General Air Cargo (2025)
Air Cargo Tonnage
(in Millions)
100 +
75 +
50 +
< 50

Figure 4

E-Commerce Air Cargo (2025)



It should be noted that in the cargo allocation process, at passenger airports passenger/belly cargo flights are added until a specified passenger load factor is attained (such as 60%). The RADAM methodology uses a slightly lower load factor when there is an excess demand for air cargo since it is assumed that the added belly cargo will increase the feasibility of more passenger flights. Cargo payloads assumed by the model for all-cargo flights in the 2001 regional aviation plan (by 000's of pounds) ranged from 70 for short-haul flights, 72 for medium-haul, 127 for long-haul, and from 228 to 245 for international flights, depending on world region served. For belly cargo, payloads assumed are 17 for short-haul flights, 22 for medium-haul flights, 32 for long-haul flights, and from 50 to 77 for international flights, depending on world region served. These payload factors are being updated for the 2004 regional aviation plan. The update will account for recent shifts in cargo volumes from passenger planes to all-cargo freighters and other transportation modes, that occurred primarily as a result of the new security requirements and procedures that were imposed after the events of September 11.

III. Defining Air Cargo Alternatives

A. Key Variables and Assumptions

In order to be subject to RADAM cargo analysis, aviation system alternatives must specify all of the air carrier airports in the regional system, and any constraints at airports in terms of either passengers served or total operations (per day or year). Any new airports that are assumed to function as all-cargo airports must also be specified in order for RADAM to simulate their potential effect on regional air cargo distribution. Key input variables that could change allocations to all-cargo airports include data on availability and cost of on- and off-airport cargo-compatible land uses (such as for warehousing) and location of new intermodal transfer centers (i.e., truck and rail transfer centers). It could also be assumed that major shippers and/or carriers would have contractual relationships with particular all-cargo airports in the future, which could substantially increase their allocations. Existing contractual relationships among cargo producing companies, shippers and carriers have already been incorporated in the model via asymmetric logic. The potential for certain companies to enter into different agreements in the future can be assessed by the model, since it incorporates survey data on the primary reasons for those agreements. For example, cargo associated with companies that indicated that they would be willing to move to alternative airports that have substantially better land availability or airfield access could be reallocated by the model to proposed new airports that satisfy these attributes.

RADAM air cargo alternatives are defined and modeled in conjunction with passenger alternatives. Both passenger and cargo allocations depend on defining the number, locations and attributes of existing and proposed new airports, as well as the amount and frequency of passenger flights at each airport in the system, which are determined by first running the RADAM air passenger model. Before cargo modeling is initiated, an initial level of all-cargo flights is specified for each airport. For passenger airports, the number of all-cargo flights is either specifically identified, or default values are used for what is typical of different-sized passenger airports. Like the RADAM passenger model, the RADAM cargo model will stop adding cargo flights to an airport when cargo load factors drop below predetermined levels, set at what is deemed to be economically acceptable or normal in the industry. Load factors are driven by the amount of cargo demand that is attracted to an airport, accommodated by both belly and all-cargo freighter capacities.

For proposed new airports assumed to operate in the all-cargo mode, dedicated freighter flights are added to them to the extent that the cargo demand that is allocated to them by the model warrants. The level of demand allocated primarily depends on the location of the all-cargo airport, and competition with other cargo-handling airports in the system.

B. Defining Competitive Niches for Cargo-handling Airports

Specific roles or niches can also be defined for individual all-cargo or passenger/cargo airports that can maximize their competitive advantages. For example, an airport can be defined as serving primarily overnight and second-day express cargo that is mostly comprised of small-package domestic cargo. An airport can also be defined as serving primarily heavy or bulk cargo (either domestic or international freight) that is less time-sensitive, and which requires facilities that can accommodate large trucks and aircraft. An airport can also be defined as primarily serving the emerging e-commerce market, which is largely comprised of express cargo for domestic distribution, and places a premium on availability of land for warehousing and adjacent intermodal facilities. Large or mid-sized airports such as LAX and Ontario Airport could have an international air cargo focus, and in the case of the latter could specialize in certain international arenas currently underserved by LAX (such as Latin America).

These various possible roles for handling air cargo could serve to optimize the competitive advantages of certain airports by recognizing their inherent strengths. For example, March ARB (MAR) would have a natural niche serving the heavy-cargo market because of its large runway—at 13,000 by 300 feet the largest commercial runway in California. Southern California Logistics Airport (SCL) in Victorville and Palmdale Airport (PMD) could cater to the e-commerce market because of the availability of inexpensive adjacent land for warehousing. San Bernardino International (SBD) could be positioned as an express cargo airport, serving the overflow market from Ontario Airport as that facility increasingly serves international cargo and passengers. MAR, SBD have very good freeway access, and MAR, SBD and SBL have nearby existing or potential intermodal facilities, including rail lines, which could enhance their roles as distribution centers. In fact, several major distributors have recently located at MAR and SBD, including Philips Electronics and Walgreens at MAR, and Kohl's Corp. at SBD. SCL has extended one of its runways to 13,000 feet and is planning an additional extension to 15,000 feet that will be able to accommodate non-stop flights to Europe and Asia. Also, the massive inter-modal and multi-modal truck-to-rail, rail-to-rail, and rail-to-truck facilities being planned by the Pasha Group at SCI should be a magnet for major distributors and logistics companies. MAR could also provide ad hoc charter services for transporting high-value agricultural produce from Imperial County to international markets. A new all-cargo airport defined for Imperial County could do the same, as well as potentially serve the cross-border Maquilladora economy.

Because of the way the RADAM model works to allocate air cargo to airports, it would be a disadvantage for proposed new airports to assume that they would be all-cargo airports in terms of maximizing cargo allocated to them. This is because even minor allocations of passenger service will increase the total handing potential of a growing new airport. Passenger service makes additional belly capacity available to shippers, as well as expands the number of destinations they can transport cargo to (a new airport may not be able to attract sufficient cargo demand in its initial stages to be able to serve numerous destinations with all-cargo aircraft). Only if airports start to run out of available runway or other essential facility capacity for handling cargo would the inclusion of passenger flights begin to impede their cargo-handling potential, since capacity-constrained airports can accommodate much more cargo per aircraft employing only all-cargo freighters. In the 2030 Preferred Aviation Plan in the SCAG's 2004 Regional Transportation Plan, substantial numbers of air passengers are allocated to all of the suburban airports including PMD, MAR, SBD, and SCL as part of it decentralization strategy. The linkage of these airports to urban population and employment centers via a proposed high-speed Maglev system greatly increases the overall accessibility of these airports and allows them to attract substantial numbers of air passengers over the long term.

In reality, however, it may be a more viable strategy for some airports to serve as all-cargo facilities in the short term since start-up costs for cargo are substantially lower, not requiring elaborate and expensive passenger terminals, parking and ground access facilities. Also, at the beginning stages of their development they may not have the critical mass of demand needed to induce passenger airlines to invest in them. The viability of all-cargo airports is further discussed in the following section, which profiles a number of successful (and one unsuccessful) all-cargo airports around the country.

Case Studies of All-cargo Airports

A. Summary

Five all-cargo airports around the country were examined and their histories profiled to identify essential elements of successful all-cargo airports. Three of these airports are unqualified successes as all-cargo facilities: Fort Worth Alliance Airport, Rickenbacker Field, and Mather Airport. One of these airports saw a period of robust growth but has recently stagnated: Willow Run Airport. The last airport can be considered unsuccessful to date since it has yet to attract any all-cargo carriers despite substantial investments: GlobalTranspark. The experiences of these airports will hopefully be instructive for airports in the SCAG Region that are striving to establish themselves as all-cargo facilities.

B. Fort Worth Alliance International Airport

Fort Worth Alliance International Airport is located 15 miles north of downtown Fort Worth and 15 miles west of Dallas/Fort Worth International Airport. Covering some 15,000 acres that span two counties and include portions of four cities, Alliance has evolved into one of the largest and most successful master planned developments in the country. Touted by master developer Hillwood Development as the "world's first master-planned industrial airport", planning for the 7500-acre Alliance Airport began in 1988 with the objective of exclusively serving business and industrial uses rather than commercial passenger traffic. The facility is based on the concept of the "inland port" that can tie directly into major markets in North America and abroad by virtue of a superior intermodal transportation system and a centralized location. Existing air, rail and highway systems have been greatly expanded and upgraded in order to connect Alliance with a full range of domestic and international markets. Business activity is further enhanced at Alliance by a foreign trade zone, an enterprise zone, a world trade center, high-tech telecommunications facilities (with state-of-the-art fiber optics), and an inventory tax exemption.

The airport currently has a 9,600-foot runway with a category III Instrument landing system (ILS), and a 24-hour FAA control tower. The airport also has a parallel 8,200-foot runway. The airport has recently received $4.5 million in Airport Improvement Program funds from the FAA to extend both runways to 11,000 feet by 2005, to accommodate larger and heavier jets with greater range. Fee simple ownership of large tracts of land with direct runway access is a unique airport feature. The U.S. Customs Service has on-site facilities, allowing international flights and cargo to be cleared at the airport.

Because of a diverse array of existing and potential tenants, including distributors, manufacturers, retailers, international firms and aviation-related companies, Alliance has been divided into distinct geographical sectors that cater to different tenant needs and requirements. These include:

- **Alliance Center**, a 2,600-acre high-density business complex that encircles the airport and is geared primarily towards aviation-related enterprises that require direct taxiway access.
- **Alliance Commerce Center,** a 300-acre business park for manufacturing and high-tech firms, which has served as a starting point for several small and mid-sized companies that have expanded into larger facilities throughout Alliance.
- **Alliance Air Trade Center**, a 52 acre air cargo development with direct access to the Alliance Airport runway system, direct access to Interstate 35W, and nearly adjacent to the BNSF intermodal facility. It has over 250,000 square feet of warehouse space available for intermodal cargo and international air freight companies.
- **Alliance Gateway**, a 2,400-acre distribution, manufacturing and office sector which provides parcels of land for constructing large-scale facilities such as warehouses and is designed to accommodate large distribution and industrial firms. It also has convenient access to Dallas/Fort Worth International Airport via State Highway 170.
- **Alliance Advanced Technology Center**, a 1,400-acre complex that is becoming one of the nation's premier technology hubs for major companies from around the world.
- **Heritage Reserve at Alliance**, which is integrated into a woodlands greenbelt and offers locations for research and development facilities in a natural setting.
- **Westport at Alliance**, a 1,500-acre industrial and distribution sector located directly adjacent to Burlington Northern Santa Fe Railway's main north/south line and Intermodal Center. It caters to shippers needing rail access and other multimodal transportation options.
- **Alliance Crossing**, a 170-acre retail complex that is designed to accommodate retailers, restaurants and other service-oriented firms needed to service the area's increasing population base as well as employees and visitors of Alliance.

To date a total of $164 million in total public investment (city, state and federal) has been made in Alliance, along with a total of $1.2 billion in private investment. This investment has created a total of 3,800 permanent jobs. The airport and surrounding development area currently support a total of 29 tenants occupying about 4.92 million square feet of space. Among the tenants are FedEx, which is constructing its 230,000-sq. ft. state-of-the-art Southwest regional sorting hub, and American Airlines, which recently established a $481 million aircraft maintenance and engineering center at Alliance.

The success of Alliance is attributable to several key factors. First of all, the infrastructure of Alliance facilitates seamless access to the three major methods of goods movement—rail, air and truck—allowing companies to move products quickly and efficiently. On the western border of the park, BNSF Railroad operates a 735-acre intermodal rail yard where shipping containers can be loaded and unloaded or switched between rail and truck without repacking the goods. Alliance has designated 1,500 acres immediately east of the intermodal yard for rail clients to locate distribution centers. Major ground transportation routes through Alliance include I-35W and State Highways 170 and 114. Businesses at Alliance not only have very good airport access at Alliance, with parcels available at Alliance Center that have direct taxiway access, Dallas/Fort Worth International Airport, which complements Alliance's other travel services, is only 20 minutes travel time to the east.

Secondly, a variety of economic incentives have been made available to spur business development at Alliance. These include a foreign trade zone designation, which is defined by federal law as operating outside U.S. customs territory. Nearly all foreign or domestic merchandise that can legally be imported can be brought into a foreign trade zone without being subject to customs laws governing the entry of goods or payment of duty. Inventory can be held within the zone without paying import duty until it is sold or otherwise transferred out of the zone (goods that are re-exported out of the zone avoid duties entirely). Also, manufacturers in foreign trade zones have a choice of paying duty either on the finished products or on the component raw materials imported from abroad that typically have higher duty rates than the finished products. Further, goods held in a foreign trade zone are exempt from state and local personal property taxes. Other advantages of foreign trade zones include the ability to return inferior or damaged goods to the country of origin without paying duties, and the ability to exhibit goods within the zone prior to sale. Besides its foreign trade zone designation, Alliance enjoys a freeport tax exemption, which allows businesses to pay no property tax on inventory that leaves the state within 175 days. Alliance offers a triple freeport tax exemption, which means that all three primary taxing jurisdictions—school, county and city—honor the inventory exemption. Enterprise zones are a third economic incentive offered at Alliance, which encourage job creation and capital investment in designation areas for a period of seven years.

Thirdly, a variety of service companies have sprung up at Alliance that provide support services to larger firms. Notable among these are third-party logistics (3PL) providers, which perform operational tasks companies want to outsource. Common tasks conducted by 3PL firms include transportation, warehousing, e-commerce fulfillment, distribution packing or assembly, production status, inventory management, transportation tracking, and returns management. Alliance operates its own 3PL firm, called Alliance Operating Services. AOS provides such services as foreign trade zone assistance, overseas container processing and third-party warehousing. A number of other 3PL firms also operate at Alliance, producing a wide range of possibilities for tenants seeking to outsource part of their operations.

Fourthly, a variety of educational and technical training programs also are provided at Alliance. The Alliance Opportunity Center offers technical training for companies located at the park. Texas Christian University's TCUglobalcenter at Alliance offer advanced degrees and provides conferencing facilities. TCU conducts an executive MBA program, one-day corporate training seminars and provides advanced teleconferencing capabilities at Alliance.

Lastly, Alliance offers the services of a new Hillwood division, TeraSpace Networks, to build and market data centers in metropolitan areas across the country. TeraSpace has recently completed the first phase of a 1.1-million-square-foot Internet data center on the eastern side of Alliance. The company also provides power and fiber optic connectivity to more than a dozen web-hosting and carrier-hotel companies that offer their services to Alliance tenants. More than 60 miles of redundant fiber optic cable with a dual grid power system has been laid in and around Alliance, providing tenants with optimum telecommunications connectivity.

Companies originally chose to locate at Alliance because of its availability of relatively cheap developable land, access to large work force, access to intermodal facilities, and economic inducements. As these businesses began to adopt high-tech approaches, Alliance, under the hands-on management and guidance of Hillwood, has evolved from a traditional distribution center to a highly automated logistics command center. The introduction of fiber optic cable and other high-tech systems, along with the location of a number of 3PL firms at Alliance, spurred this evolution. Alliance has been labeled an "e-commerce fulfillment center," because of the prominence of companies that are engaged in filling business-to-business and business-to-consumer orders via the Internet. The most prominent of these businesses include AT&T Wireless, Ameritrade, W.W. Grainger, Del Computer, and UPS Logistics Group.

About 4.38 billion dollars have been invested so far in Alliance, 96.7% from private sources. This investment has translated to 18,167 permanent jobs created and $147 million in property taxes generated over the last ten years.

C. Rickenbacker International Airport

Rickenbacker International Airport is a 5000-acre all-cargo airport that is located in Columbus, Ohio. It was the first public use airport in the United States that operated as a substantial all-cargo facility, and is currently the largest public all-cargo airfield in the world. Rickenbacker is a former strategic air command (SAC) base that was designed for heavy lift, as evidenced by its parallel 12,000-foot runways and massive fueling facilities. The base was realigned in 1980, with control transferred to the Ohio National Guard. The Franklin County Board of Commissioners formed the Rickenbacker Port Authority to operate and develop a civilian airport at Rickenbacker upon execution of a joint use agreement with the National Guard. The transfer of 1,642 acres of excess land from the Air Force to the Port Authority was completed in 1984. An additional 1,606 acres were transferred in 1993 and the remaining 1,860 acres were transferred in 1994.

The airfield is not a true joint use airport since the Port Authority now operates the facility and the military is one of many tenants. The Port Authority currently has a productive and cooperative agreement with the National Guard where facilities, services and expenses are shared between the military and civilian sectors (the Guard pays $290,000 annually to the Authority to defray maintenance expenses and provides crash/fire/rescue services).

Rickenbacker did not become an economic success until after 1990, when a new management company was hired, and a new marketing strategy developed, based on the Greater Columbus Inland Port Concept. This concept identifies the airport as part of a larger, comprehensive regional transportation system that recognizes Central Ohio's strategic location midway between New York and Chicago, and the immediate area's exceptional highway and railroad access. It offers an efficient, cost-effective alternative to increasingly costly, congested, and inefficient traditional gateway ports, which typically lack the development and multi-modal transportation opportunities afforded at inland ports such as Rickenbacker. Local business and political leaders had decided that a typical 40-ton cargo container could arrive at port in New York, be unloaded, shipped by rail to Columbus, clear customs, be broken down into smaller units and driven to East Coast location faster than if processed entirely in New York. Their judgement turned out to be correct—it can be done a day faster due to the customs and cargo processing delays at the congested and capacity-constrained Port of New York.

The biggest advantage that Rickenbacker has as a distribution center for both domestic and international air cargo is its location. Columbus is within a one-day truck drive or a 90-minute flight of more than half of the population, employment, retail purchasing power and manufacturing capacity of both the U.S. and Canada. Rickenbacker has convenient access to the nine state and federal freeways and highways that intersect in Central Ohio, and link Columbus to major markets in New York, Chicago and Atlanta. Although the airport has been specifically designed to accommodate air cargo aircraft and trucks, it is also situated near several intermodal rail terminals operated by Norfolk Southern and CSX railroads. Lastly, Rickenbacker is located within a rapidly growing metropolitan area of 1.4 million people with a workforce exceeding 700,000 workers.

Creation of a foreign trade zone at Rickenbacker in 1987 was an additional factor that contributed to its success. In addition to the advantages conferred by its foreign trade zone, Rickenbacker also enjoys an exemption from state inventory taxes, and a 15-year (starting in 1992) abatement on real estate taxes for improvements to land and buildings. Further, the airport enjoys a subsidy of about $3 million per year from local government, and the State of Ohio has pledged a total of $65 million in revenue bonds for future facility improvements.

Recent growth in and around Rickenbacker International Airport has been robust. The airport anchors the southern end of a 15 thousand-acre industrial zone known as the Rickenbacker Area, which is rapidly developing in response to the growth in the global marketplace. It contains over 22 million square feet of class “A” distribution and logistics space that employs over 15,000 workers. The Rickenbacker Port Authority has developed Ten million square feet over the last ten years in the Foreign Trade Zone industrial park at Rickenbacker. The additional 12 million square feet have been developed in 12 other industrial parks in the Rickenbacker Area over the last five years. Ample room still exists for additional growth—only 40% of the area’s land suitable for industrial projects has been developed thus far.

Currently, more than 60 companies now do business at Rickenbacker, including several Fortune 500 firms. These companies employ about 5,000 civilian employees at Rickenbacker. Eagle Global Logistics and Forward Air have established national truck hubs at Rickenbacker and regional gateways are operated by Federal Express and United Parcel Service. A number of logistics companies have also located at Rickenbacker, including Exel, one of the world’s largest supply chain management companies. Exel’s

23,000-square foot all-inclusive facility at Rickenbacker consolidates all of Exel's capabilities at one location. These include airfreight forwarding, customs brokerage, truck brokerage, intermodal operations, logistics and warehousing. Logistics and e-commerce fulfillment firms are supported at Rickenbacker by telecommunications services including state-of-the-art fiber optic lines, high-speed data circuits, and video-teleconference capabilities.

In the 1990's, air cargo volumes handled at Rickenbacker increased by an average of 15% a year, double the national average. While cargo handled by major airports in the U.S. decreased by 9.4% in 2001 compared to 2000, cargo handled at Rickenbacker increased. In 2001, Rickenbacker handled 106,680 tons of freight, slightly over the 2000 figure of 106,040 tons. About 45% of the cargo handled by Rickenbacker is international. While the total number of flights at the airport declined in 2001 compared to the previous year, a greater number of larger cargo aircraft utilized the airport. This increase was due in large part to FedEx's new contract with the U.S. Postal Service.

Cargo operations at Rickenbacker are enhanced by the development of Rickenbacker's 500,00-sq. foot Air Cargo Terminal Complex, which is being continually expanded. It provides direct airfield access to freight forwarders, shippers, logistics companies, and other looking capitalize on an airside, Foreign Trade Zone location. The Air Cargo Terminal Complex is being developed by the Franklin County Improvement Corporation, which was created in 1994 by the Rickenbacker Port Authority and the Franklin County Commissioners to develop specialized facilities backed by joint ventures and private financing. More than three million square feet of additional air cargo facilities are planned for development during the next five to ten years. Also, a total of 167 acres of common-use ramp space is currently available, with additional ramp space planned for development. The Columbus District Office of the U.S. Customs Service in headquartered at Rickenbacker, allowing agents to quickly respond to international cargo arrivals.

The Rickenbacker Port Authority has recently received a $5 million grant from the FAA's Military Airports Program for the construction of a small charter passenger terminal. The terminal will include areas for ticketing and baggage handling, as well as passenger amenities and concessions. It will also include roadway improvements, public automobile parking and related airside improvements, including and aircraft parking area adjacent to the facility. The overall terminal complex will also include corporate hangars, a hotel, restaurant, offices and meeting/training facilities. The development of charter passenger service should enhance the corporate presence at Rickenbacker and stimulate new business growth, especially in light of the rapid surge of corporate aviation activity around the country that followed the events of September 11.

A new parallel runway that is at least 5,000 feet distant from the existing primary runway is planned for construction within the next fifteen years. This will allow for simultaneous instrument flight rules (IFR) landings that are not possible with the existing runway configuration because the parallel runways are too close together.

The success of Rickenbacker International was the catalyst for the creation of the Greater Columbus Inland Port Commission in 1991, which promotes trade and the development of intermodal infrastructure for freight shipping and distribution in the Columbus area. It is a true public/private partnership that is made up of city, county, state and federal representatives on the public side, and the Greater Columbus Chamber of Commerce as well as individual manufacturers, shippers, carriers and other service providers from the private sector. Participation by the nationally acclaimed Transportation and Logistics Department of the University of Ohio provides academic input to the Commission.

In the period 1981-1991 ("Base Conversion Period"), Rickenbacker drew a total of $72.8 million in public capital investment and $1.7 million in private capital investment. Public investment sources included 49% from the Rickenbacker Port Authority (mostly revenue bonds), 23% from Franklin County, 17% from the State of Ohio, and 11% from the FAA and Department of Defense. In the period 1992 to 2000 ("The Renaissance Period"), the facility drew a total of $111.7 million in public capital investment and $403.0 million in private capital investment. Public investment sources included 52% from the FAA and DOT, 21% from the State of Ohio, 12% from the Rickenbacker Port Authority, 11% from Franklin County, and 4% from other local sources.

As a cargo airport, Rickenbacker receives a variable entitlement of about $500,000 annually from the FAA, based upon cargo tonnage handled. The airport is not entitled to any of the 96% of available federal airport funding which is based on passenger activity at airports. Consequently, the Port Authority is expanding its business services to include charter passengers in 2003 in order to become eligible for federal grants needed to provide for minimal maintenance of the airfield.

To date, every dollar of public investment in Rickenbacker has produced over $3 in direct private investment, and $25 in regional economic impact. A recent economic study estimates that Rickenbacker Airport currently generates over $811 million in economic impact to the Greater Columbus Region, and supports over 7,600 jobs. Businesses located in the Foreign Trade Zone generate an additional $951 million to the regional economy and support almost 10,500 jobs. An additional $988 million is generated by Rickenbacker Area development outside the boundaries of the Rickenbacker Port Authority. The total impact of Rickenbacker and Rickenbacker Area development to the regional economy is currently about $2.8 billion. This is forecast to increase to $3.8 billion in 2006 with the development of the International Facilities Complex, which will include a passenger terminal, hotel and conference center, and corporate hangars.

D. Mather Field

Mather Field is located 12 miles east of downtown Sacramento off of U.S. Highway 50. It was originally an Air Force center for pilot, navigator and bombardier training, as well as a base for a Strategic Air Command B-52 squadron. In 1988 the closure of Mather as a military facility was announced, and the base was officially closed in 1993, with the loss of 7,600 military and civilian jobs. After the base property was transferred to the County of Sacramento, the base was officially reopened as a civilian airport in 1995.

This was consistent with a comprehensive reuse plan developed by the County in 1991, which called for the retention of aviation use at the facility. Since 1995, the facility has concentrated on serving air cargo and general aviation, as well as complementary commercial and office development in adjacent areas.

The original Mather Field was comprised of 5,700 acres. The three largest property conveyances from the Federal government to public and private entities include Mather Airport (2,875 acres), Mather Regional Park (1,600 acres), and Mather Commerce Center (760 acres). The airport is comprised of two parallel runways, 11,300 feet and 6100 feet, a 24-hour air traffic control tower, and 120 acres ramp space for parking aircraft, four aircraft hangars, and a number of office and industrial structures. The largest runway is capable of handling the largest, fully loaded aircraft.

Since it opened in 1995, major improvements at Mather Field include a new 24-hour control tower, crash, fire and rescue services, a new 15,000-square foot general aviation terminal, an automated weather observation system, and new fueling facilities with one million gallons of Jet A storage capacity.

A notable development of the transition of Mather Field into a commercial air cargo hub was the relocation of the operations of Airborne Express and Emory Worldwide from Sacramento International Airport to Mather in 1996. Airborne, with about 80 employees, initially used half of an unoccupied hangar at Mather until its new 32,000 square foot permanent facility was completed in 1998. Emery Worldwide originally used half of a large warehouse building for its sorting operations, and in 1999 constructed a new 28,000 square foot sorting facility. BAX joined the other cargo carriers at Mather in 1997, and in 1998, United Parcel Service also relocated its operations and 125 employees from Sacramento International Airport to Mather, effectively doubling the air cargo tonnage handled at the airport. Other carriers that have operated at Mather Field include Kitty Hawk and Polar Air, although these carriers (along with BAX) discontinued scheduled service in 2001.

Cargo tonnage handled at the airport rose from 23,775 tons in 1996 to a historic high of 78,280 tons in 1999. However, tonnage decreased by 5% to 74,371 in 2000, and decreased by a whopping 35% from 2000 to 2001. This was mainly due to the worsening economic downturn and the departure of Kitty Hawk with its 13 flights per day from Mather Field after the US Postal Service shifted service from Kitty Hawk to FedEx in November, 2001. Airmail from the Sacramento area is now flow out of Sacramento International Airport via FedEx, or trucked to Oakland International Airport. In 2002 cargo activity at Mather has been stabilizing, although it is still down from 2001 levels.

Mather Field is operated by the Sacramento County Department of Airports, which also operates Sacramento International, Sacramento Executive, and Franklin Field airports. In October 2001 the Sacramento Board of Supervisors adopted a resolution which defined the roles of the airports in the county system. They include:

- Sacramento International: Scheduled airline service with some air cargo and general aviation uses
- Sacramento Executive: Dedicated general aviation use within the limits established by the airport's noise ordinance and weight restrictions
- Franklin Field: Dedicated general aviation use with emphasis on flight training and preservation of open space for future general aviation development
- Mather Field: Either (1) Dedicated air cargo use with some general aviation uses; or (2) Dedicated air cargo use with emphasis on facilities to support air cargo hub operations with some general aviation uses

The air cargo volumes handled at Sacramento International Airport are carried by the passenger airlines utilizing their available belly capacity, as well as the integrated all-cargo carriers including FedEx and DHL. Located to the west of downtown Sacramento, it does not directly compete with Mather since it serves at different client base, such as Hewlett Packard, located in the western portion of the Sacramento Metropolitan Region.

An airport master plan for Mather is currently being prepared, which is evaluating the various airfield and groundside facilities needed to implement the defined alternatives for Mather over the long-term. It is also assessing how to mitigate potential environmental impacts on surrounding land uses. This is a significant issue at Mather since a number of residential developments have recently been built around the airport, some under its final approach path, that were attracted to the vicinity of Mather due to nearby office parks. Also, several new school sites have been proposed close to the airport. A proposed runway extension to the shorter of the airport's two runways has run up against opposition from community groups concerned about potential noise and safety impacts.

One of the keys to the early success of Mather as an all-cargo airport after its closure as a military air base in 1993 was the ability of the County to offer incentives for carriers to use Mather. As the regional airport authority for the county, the Sacramento County Airport System (SCAS) is responsible for planning, developing, operating and maintaining Sacramento County's airports, including Mather Airport. The SCAS covers the operating needs and costs for all the county airports. In its initial development stages before it attracted a carrier, the SCAS covered all the financial losses at Mather, including opening a line of credit. Losses were rolled into the landing and rental fees at the other airports. The SCAS also actively promoted Mather's advantages to prospective tenants, including the airport's relatively inexpensive and abundant developable land.

Once Airborne located at Mather, other carriers followed when they saw that all-cargo carriers could be successful there. They found that Mather is geographically desirable due to its location along the U.S. 50 corridor where there has been a tremendous amount of office and high-tech R&D development. Besides very good freeway access, advantages of Mather as a cargo-handling airport include abundant and reasonably priced developable land, with facilities that are geared toward exclusively handling air cargo, including on-airport sorting facilities that are seamlessly connected to both runways and ground access networks. Because it is a non-part 139 airport, Mather has fewer security hassles involved with getting in and out of the facility compared with passenger serving airports. Mather also benefits from the robust economy of the Sacramento Region, which has remained relatively healthy despite the state and national economic downturns. However, the massive state budget deficit poses questions and concerns about the continued health of the Sacramento Region economy.

E. __Willow Run Airport__

Willow Run Airport is another successful intermodal and industrial all-cargo airport, located in Wayne County, Michigan, seven miles west of Detroit Metro Airport. However, its success has markedly diminished over the last several years. The case study of Willow Run Airport illustrates the potential pitfalls of serving a very narrow niche market.

Occupying 2,700 acres, Willow Run Airport is solely dedicated to business aviation, general aviation and air cargo. The airport has five all-weather runways, ranging from 6500 to 7500 feet in length, all capable of handling Boeing 747 cargo jets. The facility dates back to 1941, when Henry Ford and Charles Lindbergh built the world's largest bomber facility at the airport. The plant employed 42,000 workers during its peak, and 8,700 B-24 bombers were built there. After the war, the bomber plant was converted to a luxury passenger terminal, and Willow Run became Detroit's principal airport. However, by 1966, all commercial airline traffic had moved to Detroit Metro Airport, and Willow Run has been a cargo, general aviation and executive airport ever since.

For many years after airline activity moved to Detroit Metro, Willow Run Airport was largely idle, serving an occasional freight operation. However, when the auto industry became more globally oriented in the 1990's, outsourcing many of its component parts to foreign countries and shipping parts to international destinations for assembly, companies sought out Willow Run as an alternative to Metro Airport. With less congestion, more loading docks, more available ramp space and easier customs clearance, valuable time could be saved in processing cargo at Willow Run, and cargo planes could be in the air within minutes of leaving the loading area. This time savings is very important to the carriers which use Willow Run, which are entirely charter carriers that provide premium ad hoc/expedited service including emergency deliveries. They utilize a high percentage of corporate jet aircraft. Fueled by the auto industry, cargo activity at Willow Run soared in the late 1990's. It jumped from being the 85th busiest cargo airport in the nation, to third busiest in 2000, just behind Memphis Airport.

However, cargo volumes at Willow Run declined by about 56% from 1999 to 2001, according to the most recent available data. This was primarily due to the marked slowdown of the U.S. auto industry over the last several years. A general restructuring of logistics management in the auto industry also contributed to the decline. With a far-flung network of suppliers with diverse product lines that require integrated supply chains, the use of internet-based logistics and inventory systems produced greater efficiency and lowered overall costs to the automotive industry. Widespread use of air cargo services accompanied the initial foray of the industry into global logistics and inventory/supply chain management to expedite deliveries of component parts to and from other regions of the country and foreign countries, particularly the NAFTA partner countries of Canada and Mexico. Nonetheless, as the efficiency of the inventory and supply chain management system improved over time, the need for air cargo service, with its higher transport cost, diminished to the point where it is now only used on an emergency basis. Shipment by truck or rail is now the preferred mode of delivery for automotive components on the North American continent.

Further complicating the cargo prospects of Willow Run Airport is the fact that non-automotive industry shippers and forwarders have been very reluctant to use it. The large majority of the freight forwarders serving the Detroit Metropolitan Area are located at nearby Detroit Metro Airport, where they depend on the high flight frequency and scheduled service that is available there, passenger carriers that provide belly cargo capacity. Conversely, Willow Run is dominated by charter carriers with a lack of predictable service frequency, and has no passenger service. Also, its return/back-haul cargo is unpredictable, which adversely affects overall load factors and revenues. Most carriers serving Willow Run work directly with the auto industry's logistics and shipping department since they are willing to pay higher rates. However, the downturn of the auto industry, in combination with the improved efficiency of supply chain logistics in the auto industry, is severely cutting into the business of these carriers.

The almost exclusive reliance of Willow Run charter carriers on the niche market of serving the expedited/emergency shipment needs of the automobile industry limits the long-term growth potential of Willow Run Airport. The airport does not serve a diversified market, and the successes and failures of its carriers are based largely on the fortunes of the auto industry. It is unclear whether a more diversified regional economy in the Detroit Metropolitan Region would help the prospects of Willow run Airport. Since Willow Run has been so strongly tied to the Automobile industry, any economic diversification away from auto industry dominance could hurt, not help, the vitality of the airport.

In the long run, the future of Willow Run may depend on the continued ability of Detroit Metropolitan Airport to handle to cargo volumes of the region in an efficient manner, and the ability of Willow Run Airport to attract cargo-generating industry around it. The 25,000-acre area between the two airports in largely undeveloped, and Wayne County is encouraging high-tech firms and light manufacturing to locate in this area, as well as 350 acres of land north of the airport it recently sold to private developers. A Fly-In Commerce Center located directly adjacent to the airport is proposing to construct 200,000 square feet of corporate office, distribution, and manufacturing facilities. Another promising development is the creation in August 2002 of a Wayne County Airport Authority that will run both Detroit Metro and Willow Run airports, and facilitate economic development and improvements at these two airports.   The creation of the integrated Airport Authority presents opportunities to work with Wayne County to develop the area between the two airports as an Area Trade Corridor, and to develop the two airports in a complementary and synergistic fashion. The latter could include focusing future cargo service at Willow Run Airport, including scheduled all-cargo service, with Detroit Metro Airport concentrating on serving passengers.

F. Global TransPark

Currently under construction, North Carolina's Global TransPark is located in Kinston, about 80 miles southeast of Research Triangle Park near Raleigh/Durham International Airport. Like Alliance Airport, Global TransPark plans to dramatically expand a small, existing regional airport located in a primarily rural area. It proposes an advanced concept of the new genre of intermodal, industrial all-cargo airport complexes, and has been described as "an industrial park with runways". It is based on research conducted at the University of North Carolina that argues that the next future "wave" of industrial development will be based on global just-in-time manufacturing and distribution in which flexibility and speed are critical competitive factors. Airports will consequently supplant seaports, rail hubs and highway systems as the primary generators of jobs and wealth.[3] The Global TransPark concept seeks to maximize the flexibility and speed of manufacturing and distribution by closely integrating manufacturing and air freight systems, with manufacturing facilities placed directly adjacent to runways/taxiways and air cargo terminals.

The current master plan for the development, which will cover 15,300 acres, envisions initial airfield improvements including a single 11,500-foot runway with two parallel taxiways, with another 13,000-foot runway and a new control tower to be built later on. The plan calls for direct links from a loop freeway surrounding the site to two nearby interstate highways, and connections from a planned intermodal rail yard to Norfolk Southern and CSX rail lines that run to the ports of Wilmington and Morehead City. The master plan also calls for extensive telecommunications links with electronic data interchange (EDI) capabilities and connection to the national fiber optic network, an education and training center to conduct industry research and upgrade the skill levels of employees, and an automated cargo transfer system that will shuttle cargo between tenants and to and from the central cargo facility that will have an advanced U.S. Customs Automated Manifest System for clearing international shipments.

Industrial areas are planned so as to locate industries with a high usage of air transport facilities close to the airfield, and those with a higher reliance on surface transport on the periphery. They are designed to incorporate maximum flexibility in the arrangement of sites and accommodation of needs for potential tenants, including manufacturers, assemblers, processors, and distributors.

Forecasts prepared for the master plan predict that by 2014 Global TransPark will support a total of about 23,000 cargo flights carrying 696,000 tons of cargo. This will generate a total of 23,400 direct and 26,000 indirect employees under full build-out conditions.

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[3] "An Industrial/Aviation Complex for the Future", Economic Development Quarterly, August, 1991.

Funding for infrastructure development of Global TransPark to implement master plan objectives is expected to total about $200 million. So far a total of $84.6 million of State Funds, $27.2 million of Federal funds, $30 million of private sector funds, and $3 million of "other" funds have been received, totaling $144.8 million. This is in addition to the $140 million "gift" of existing properties and facilities that were transferred by local government.

The public sector role in the Global TransPark is being led by a state agency, the North Carolina Global Transpark Authority. The authority has been given a broad rang of powers, including land-use zoning up to six miles from the GTP periphery, eminent domain, and the ability to issue industrial development and revenue bonds. In coordination with the authority, a nonprofit private corporation, the Global TransPark Foundation, Inc., will provide a wide range of services and financial resources for the project. Its board of directors is composed largely of business leaders throughout the state. In addition, a 13-county GTP Development Commission was formed to facilitate economic development initiatives and environmental planning in the region surrounding the Global TransPark. A $5 annual registered vehicle fee within these counties was approved to provide additional infrastructure support resources

Private sector development of Global TransPark was initiated in August 1996 with groundbreaking for a maintenance facility for Mountain Air Cargo/Mountain Aircraft Services, which is a major contractor for FedEx. They expect to eventually employ 300 people at its 70,000 square-foot consolidated maintenance facility at Global Transpark. Other recent developments include receipt of foreign trade zone status, extension and strengthening of the existing 7,500-foot runway to 10,500 feet (so the airport can handle fully loaded 747's), and development of a 59,00 square-foot multi-tenant air cargo building with roadway connections and direct high-speed taxiway and apron access. The GTP's state-of-the-art Education and Training Center has been open since May, 2000, has served over 20,000 people and offers an Associate Degree Program in Global Logistics Technology. Construction is complete on two new hangars and office facilities that support general aviation, and 100,00 square-foot pharmaceutical distribution facility has been built on the site. Currently, the Global TransPark supports 27 employers in its Initial Development Area, providing 2,600 jobs with $65 million in payroll and benefits.

Nevertheless, public and political opposition to Global Transpark in Eastern North Carolina has been mounting over the last several years. This opposition has been engendered primarily by the fact that despite its modest success, the GTP has fallen far short of its original forecasts and expectations. To date, no manufacturing facilities or air carriers have located to the GTP. A major blow to GTP aspirations was the decision by FedEx in April 1998 to locate its regional cargo hub at Piedmont Triad International Airport in Greensboro, which is a major commercial highway served by commercial highways. Another major impediment to growth of the GTP has been the recent sharp decline of the economy of Eastern North Carolina. GTP critics cite the location's lack of economic base, cultural amenities, and good access to major highways as reasons for the under-performance of the GTP, labeling it a "field of dreams" that repudiates the rosy axiom "build it and they will come." There has been significant erosion of political support of the GTP over the last year. This is evidenced by a recent halving of State budget support for the GTP, from $3.4 million per year to $1.6 million per year, and a majority of candidates for local office running on platforms to eliminate local government support of the GTP. State legislation was also recently passed ordering studies on how to transfer the GTP facilities from its state-created operating authority to a more appropriate government entity.

The Global TransPark case study is an excellent example of how location matters in the siting of new airport facilities, and the potential downside of overselling a development concept by raising false expectations with highly optimistic forecasts. Still, in defense of Global TransPark it should be pointed out that it has had some modest success, more success than Rickenbacker Airport experience in its first twenty years of development. Whether Global TransPark will become a successful all-cargo airport like Rickenbacker over the long term is still an open question.

Distribution of SCAG Region 2030 Origin-and-Destination Aviation Demand

A. Introduction

There are two types of passengers that pass through airports: Origin and Destination (O&D) and Connecting. O&D passengers are those people that either begin or end their journey somewhere in the region. Connecting passengers are the travelers that do not leave the airport, but just connect to a different flight. A common example in the SCAG region is a passenger that arrives from the East Coast and connects with a flight to Asia. An Origin and Destination passenger does not have to be a resident of the region. Any tourist coming to Southern California is also an O&D passenger, even though they end the first leg of their journey at a hotel.

For purposes of airport ground access and capacity planning, and economic impact analysis, the split between O&D and connecting passengers is very important. Connecting passengers usually do not use the local road system, or contribute to the tourist economy.

The RADAM model used by SCAG to develop its aviation forecasts not only forecasts passenger demand by airport, but can be configured to separate connecting passengers from O&D passengers. O&D passengers could start their journey at home, work, or a hotel, and the RADAM model captures these different origins, based on extensive passenger surveys taken at airports. A traveler could live Long Beach, work in Burbank and fly to Las Vegas from Bob Hope Airport after work. Standard demand models based on place of residence would not capture the geographic origin of this flight. The forecasting of future employment, housing and transportation trends are important inputs that the RADAM model uses to forecast future aviation demand.

B. County Shares of 2030 Air Passenger Demand

By aggregating demand generated in selected RADAM zones, it is possible to determine how much O&D demand each county will generate. The following table shows what percentage of regional O&D traffic each county will generate in 2030, as forecast in the Preferred Aviation Plan.

Table 1

O&D Passenger Demand by County (2030)

County	Millions of Annual Passengers	Percentage of Total
Los Angeles	89.6	61%
Orange	32	22%
Riverside	7.2	5%
San Bernardino	14	10%
Ventura	4.1	3%
TOTAL	146.9	100%

C. Distribution of 2030 Passenger Demand by Airport

Aside from generating the demand by county, RADAM also generates the O&D demand for each airport in the region. The following pages graphically show this distribution among RADAM zones for each airport in the 2030 Preferred Aviation Plan, shown in Figures ---through ---. A summary description of the O&D demand distribution for each airport precedes these figures.

Bob Hope (Figure 1)

Bob Hope Airport primarily serves demand from the San Fernando Valley, east along the I-210 corridor to the San Gabriel Valley, and west along the I-101 corridor into Ventura County. The service/catchment area of Bob Hope Airport is relatively small since it is forecast to continue to concentrate on providing service for short-haul and medium-haul passengers, who are typically reluctant to drive long distances to access their flights. In 2030, the flight portfolio for LAX will have more of an international and long-haul focus, which will place even greater pressure on Bob Hope to serve local short-haul and medium-haul demand.

Los Angeles International (Figure 2)

LAX in 2003 will remain as the primary long haul and international airport for the Southern California region, which is why it has the largest service area of any airport in the region. The greatest concentration of passenger demand to LAX will come from communities in the South Bay, Santa Monica, Malibu, and West Los Angeles, which are close to LAX and have relative high levels of disposable income. There will be moderate demand generated from the rest of Los Angeles County, as well as Orange and Ventura County. The areas with the strongest demand have no other viable airport options and will continue to use LAX for all of their air travel needs including short-haul and long-haul flights. Other adjacent areas will use LAX primarily to access its international flight options.

Long Beach (Figure 3)

Long Beach's legal constraint of 41 allowable flights per day will continue to limit its ability to attract passengers. The primary users of Long Beach Airport will be residents of south Los Angeles County and, to some extent, Northern Orange County. The flights are mostly medium haul, but without great frequency.

Ontario International (Figure 4)

By 2030, Ontario is forecast to have a very robust flight portfolio, including limited international service. The airport will attract most of its passengers from the communities directly surrounding the airport, in San Bernardino County. These passengers will use the airport for short-haul, medium-haul, long-haul and some international service as opposed to traveling to LAX. Ontario will also attract a substantial amount of demand from Orange County, as John Wayne will reach its capacity constraints long before 2030. The airport will also attract a significant number of passengers from the San Gabriel Valley and western Riverside County, as well as communities in central Los Angeles County, primarily because of the planned Maglev high-speed train connection from Union Station to Ontario.

John Wayne (Figure 5)

John Wayne Airport will primarily serve local demand from Orange County, and will continue to cater to relatively high-income Orange County travelers, primarily business travelers and tourists. The airport is forecast to continue to have a mix of short, medium and long haul flights.

March Inland Port (Figure 6)

March will primarily serve the domestic travel needs of western Riverside County. In addition, the airport would serve limited demand from northern Orange County, mainly because of the planned Maglev high-speed connection to the airport from Irvine and Corona. The airport's flight portfolio will have a variety of domestic short-haul, medium-haul and long-haul flights.

Palmdale (Figure 7)

The Palmdale Airport would primarily serve residents in north Los Angeles County. The communities of Palmdale and Lancaster would almost exclusively use Palmdale Airport. In addition, with a robust flight portfolio comprising a variety of domestic flights as well as limited international service, the airport would attract demand from the I-5 corridor communities of Valencia, and Santa Clarita. Currently these communities primarily rely on Bob Hope Airport to service their air travel needs.

Palm Springs (Figure 8)

In 2030, Palm Springs International Airport will be primarily utilized by local passengers from the Coachella Valley, including seasonal visitors to the area. There will also be pockets of demand in relatively affluent areas of Orange and Los Angeles counties, including the Malibu area. Passenger growth at the airport will be mostly related to population growth in the local area, increased tourism, and a more robust flight portfolio that will include more long haul flights.

Southern California Logistics (Figure 9)

The Southern California Logistics Airport will primarily serve short haul demand for the communities of Victorville, Apple Valley and Barstow. Ontario International Airport will still primarily serve travel needs from these communities that will require medium or long haul service. Almost none of the demand for this airport will originate from outside the Mojave Valley.

San Bernardino International (Figure 10)

By 2030, San Bernardino International Airport will primarily serve as a short haul reliever for Ontario International. Passenger demand will originate mostly from San Bernardino County, Western Riverside County and Northern Orange County. The planned Maglev system will helps to boost the demand to San Bernardino International, primarily from Orange County.

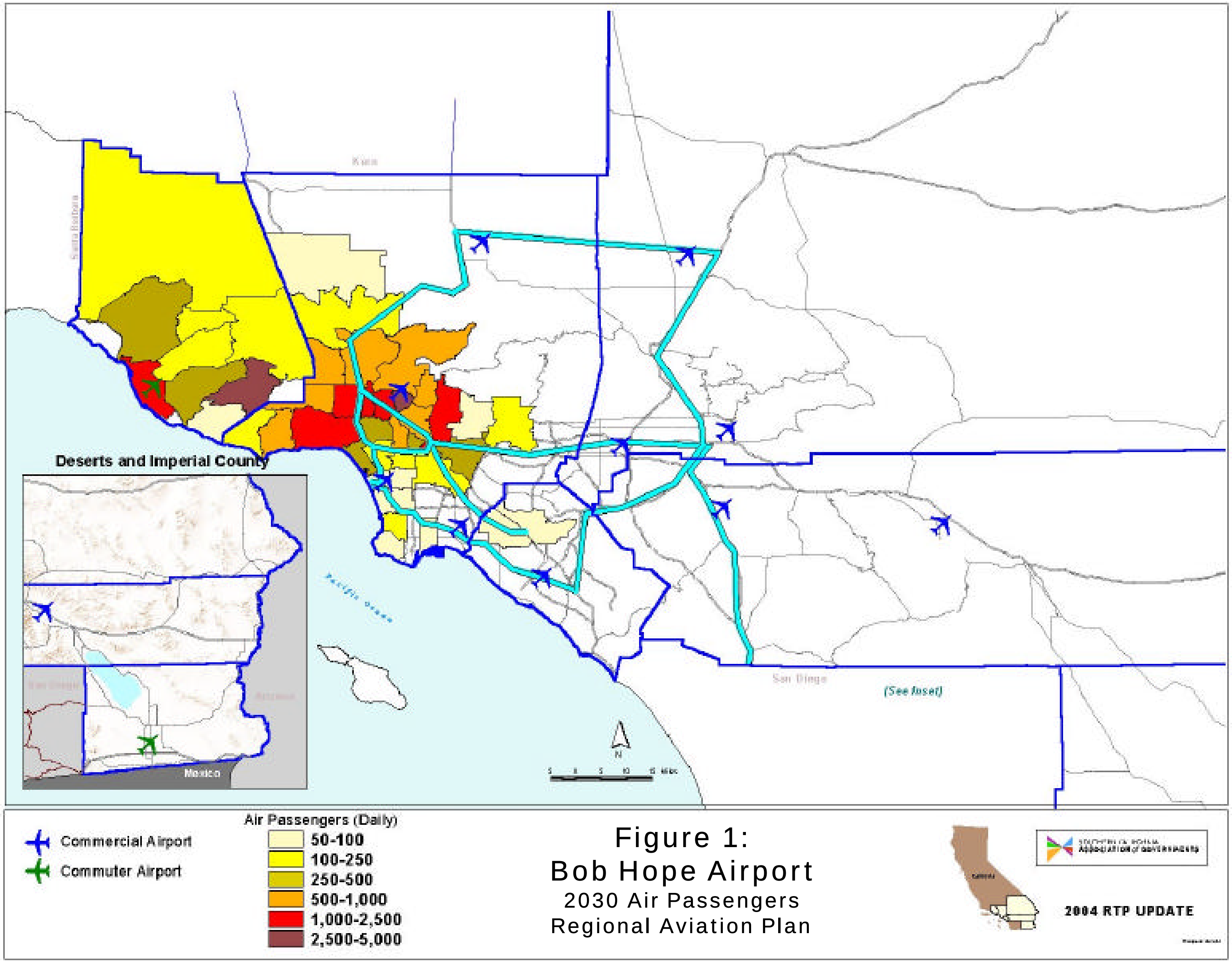

Figure 1:
Bob Hope Airport
2030 Air Passengers
Regional Aviation Plan

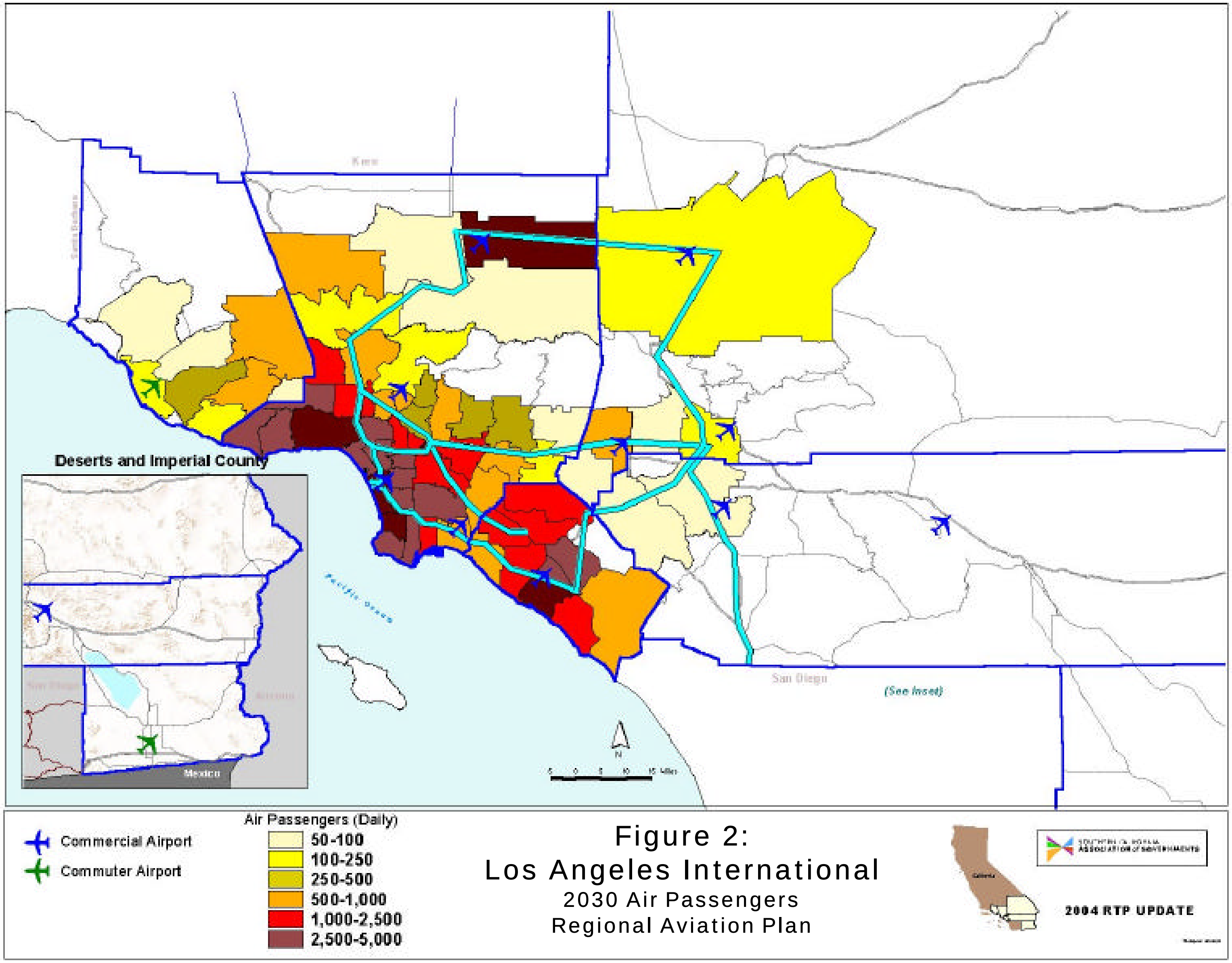

Figure 2:
Los Angeles International
2030 Air Passengers
Regional Aviation Plan

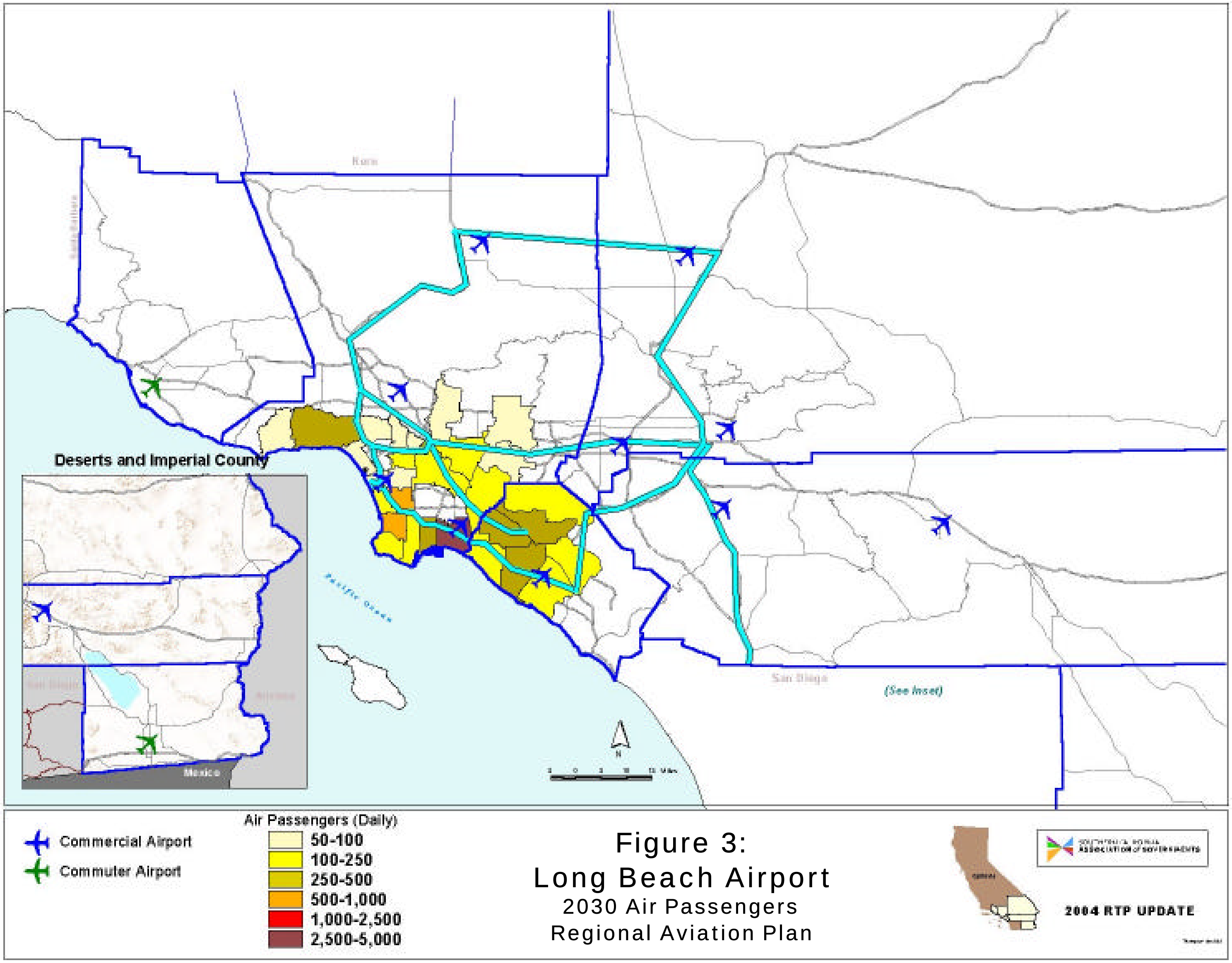

Figure 3:
Long Beach Airport
2030 Air Passengers
Regional Aviation Plan

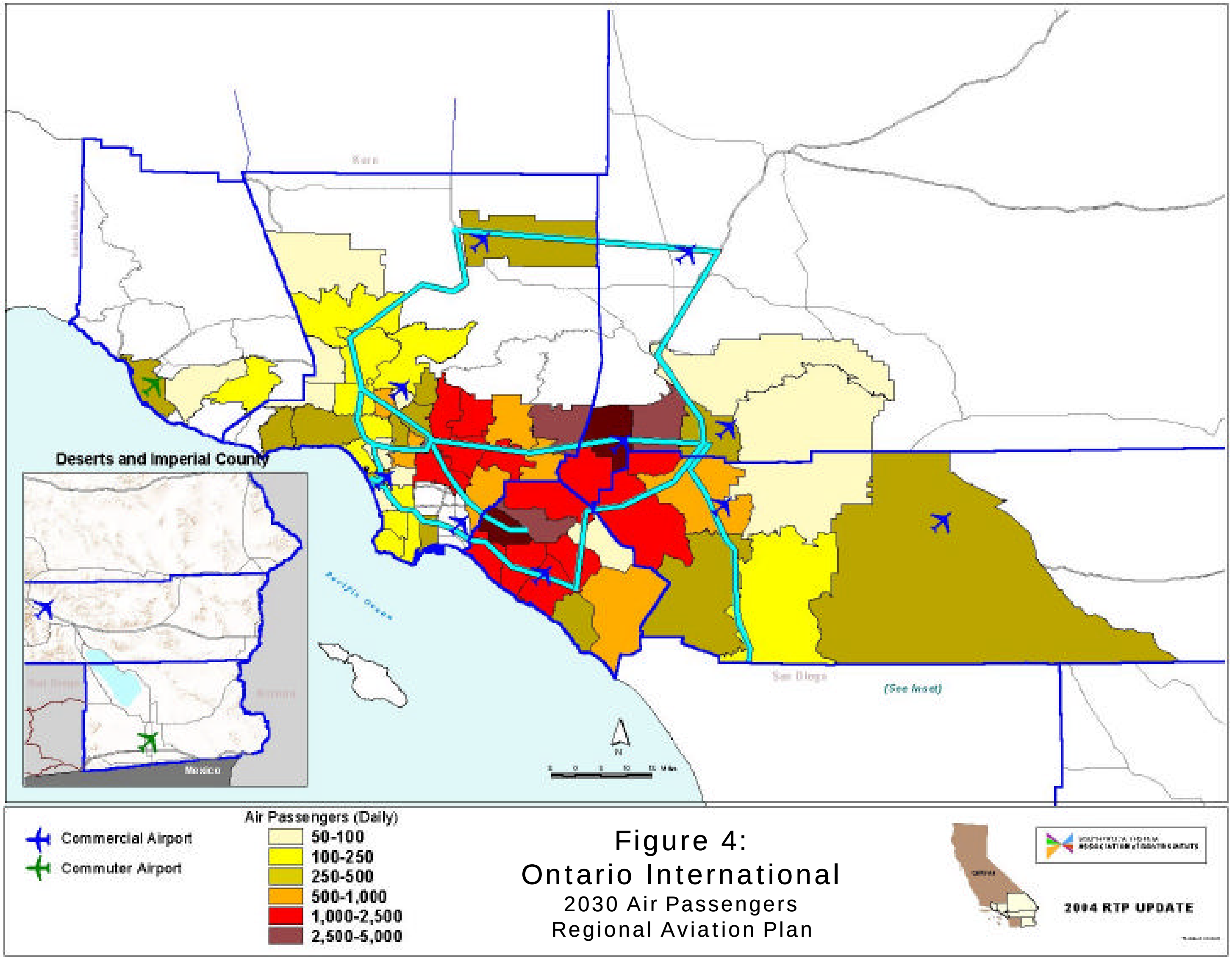

Figure 4:
Ontario International
2030 Air Passengers
Regional Aviation Plan

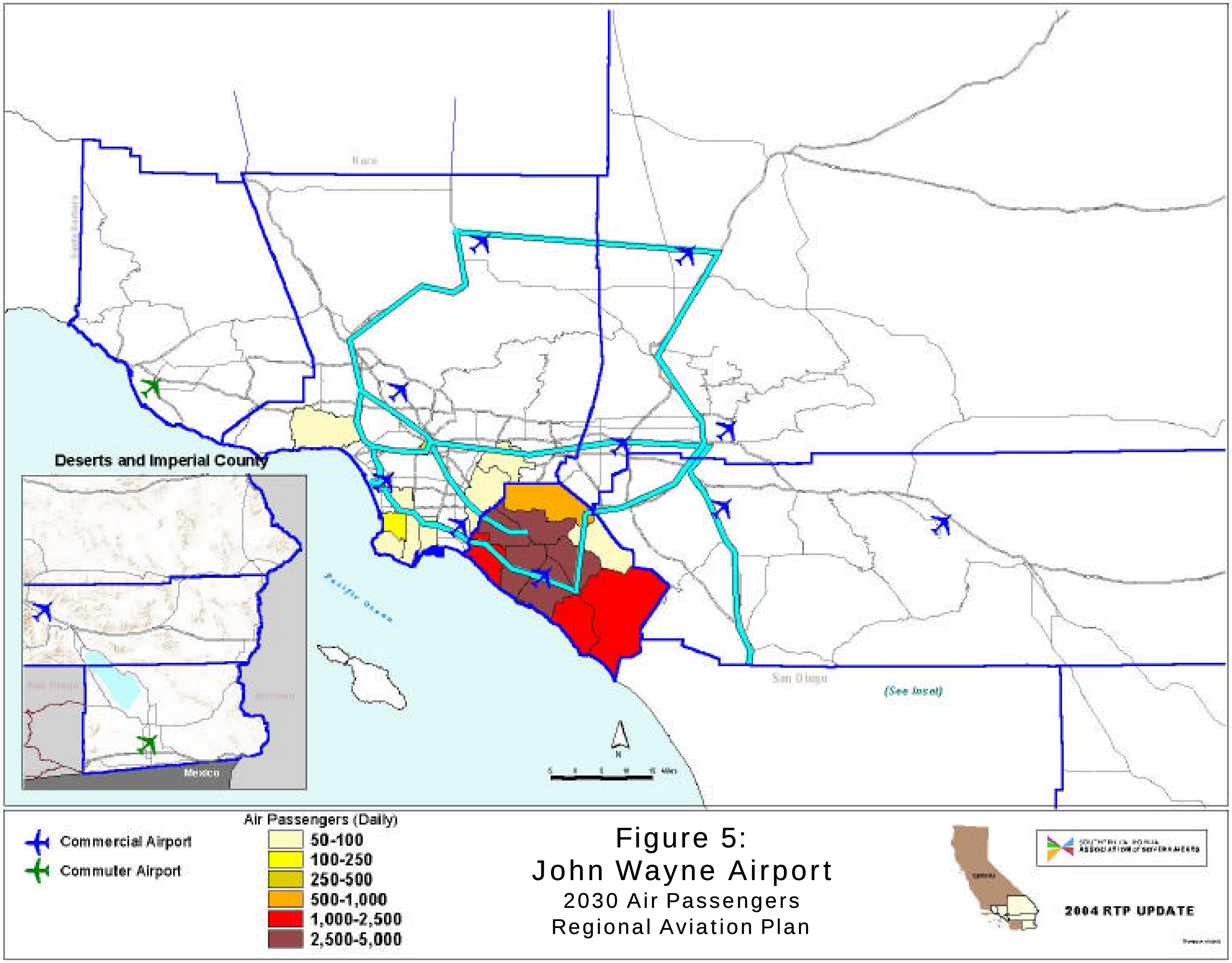

Figure 5:
John Wayne Airport
2030 Air Passengers
Regional Aviation Plan

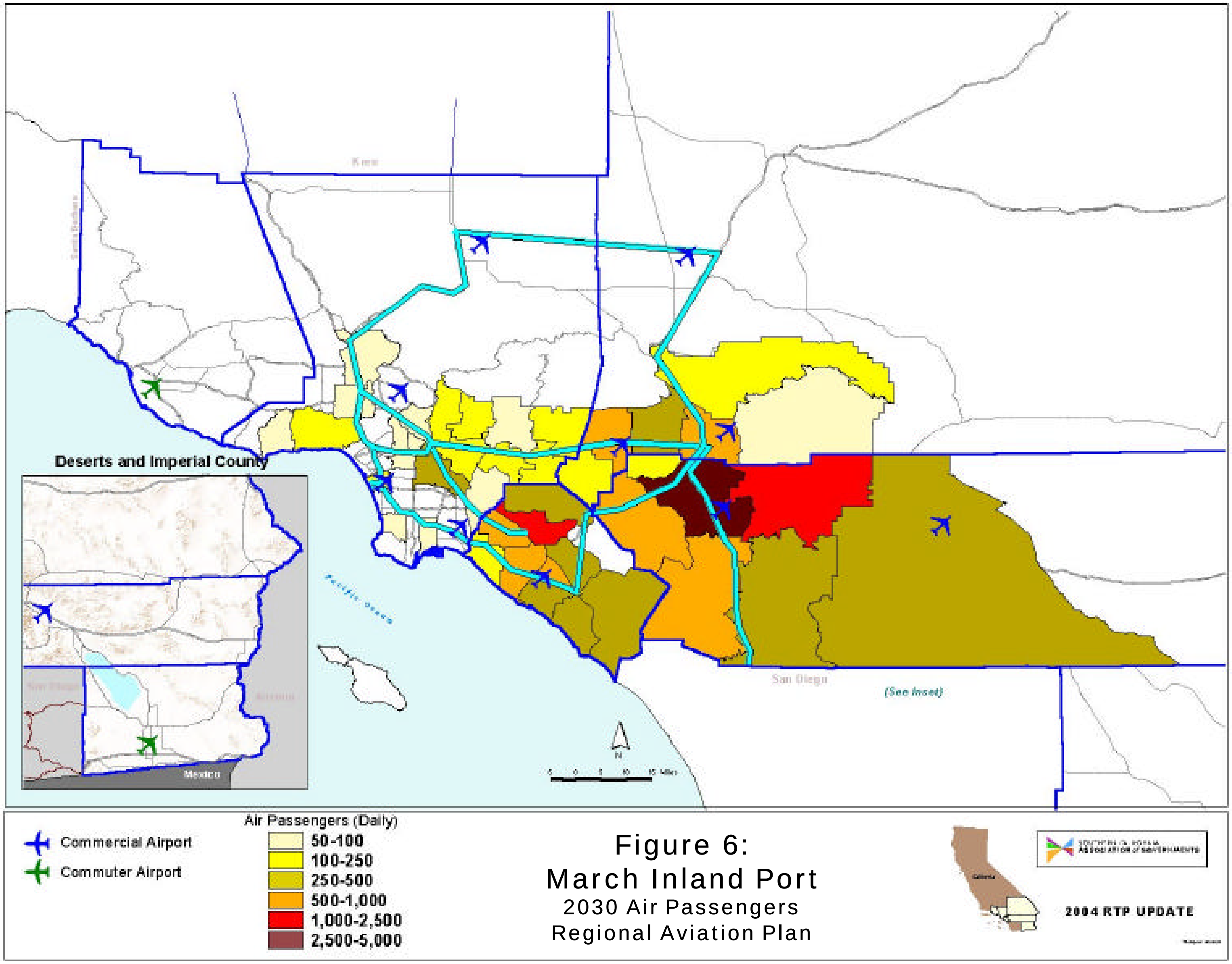

Figure 6:
March Inland Port
2030 Air Passengers
Regional Aviation Plan

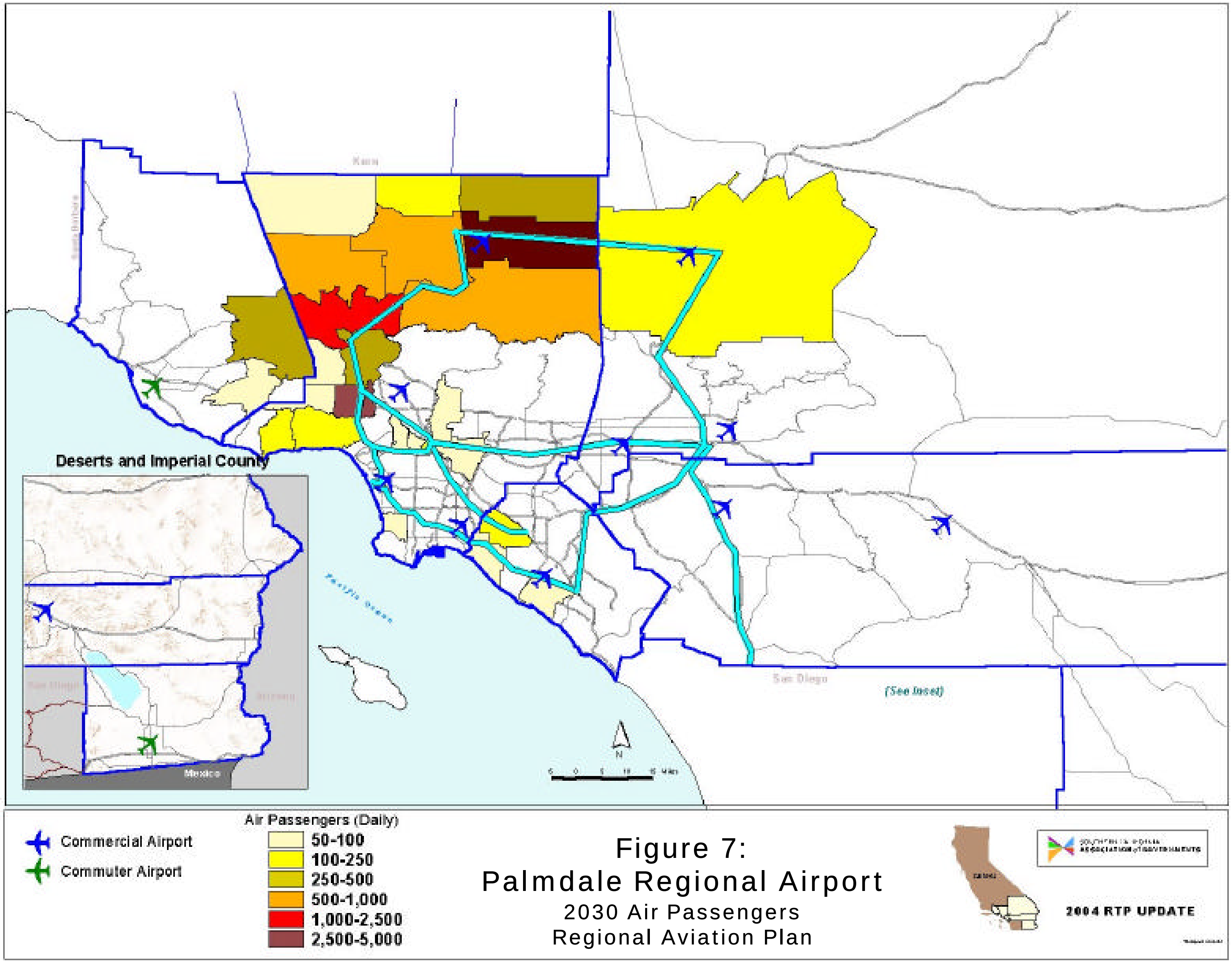

Figure 7:
Palmdale Regional Airport
2030 Air Passengers
Regional Aviation Plan

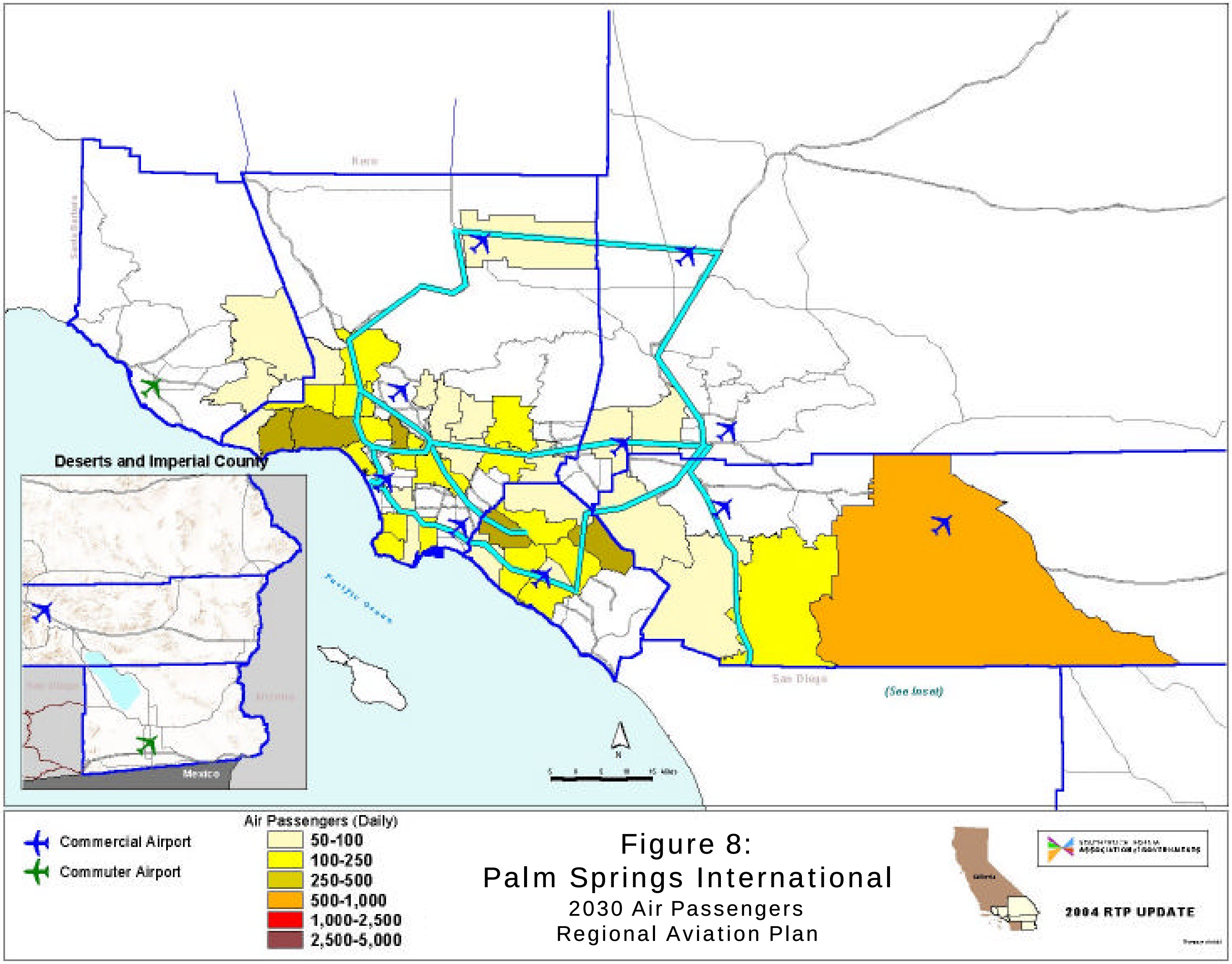

Figure 8:
Palm Springs International
2030 Air Passengers
Regional Aviation Plan

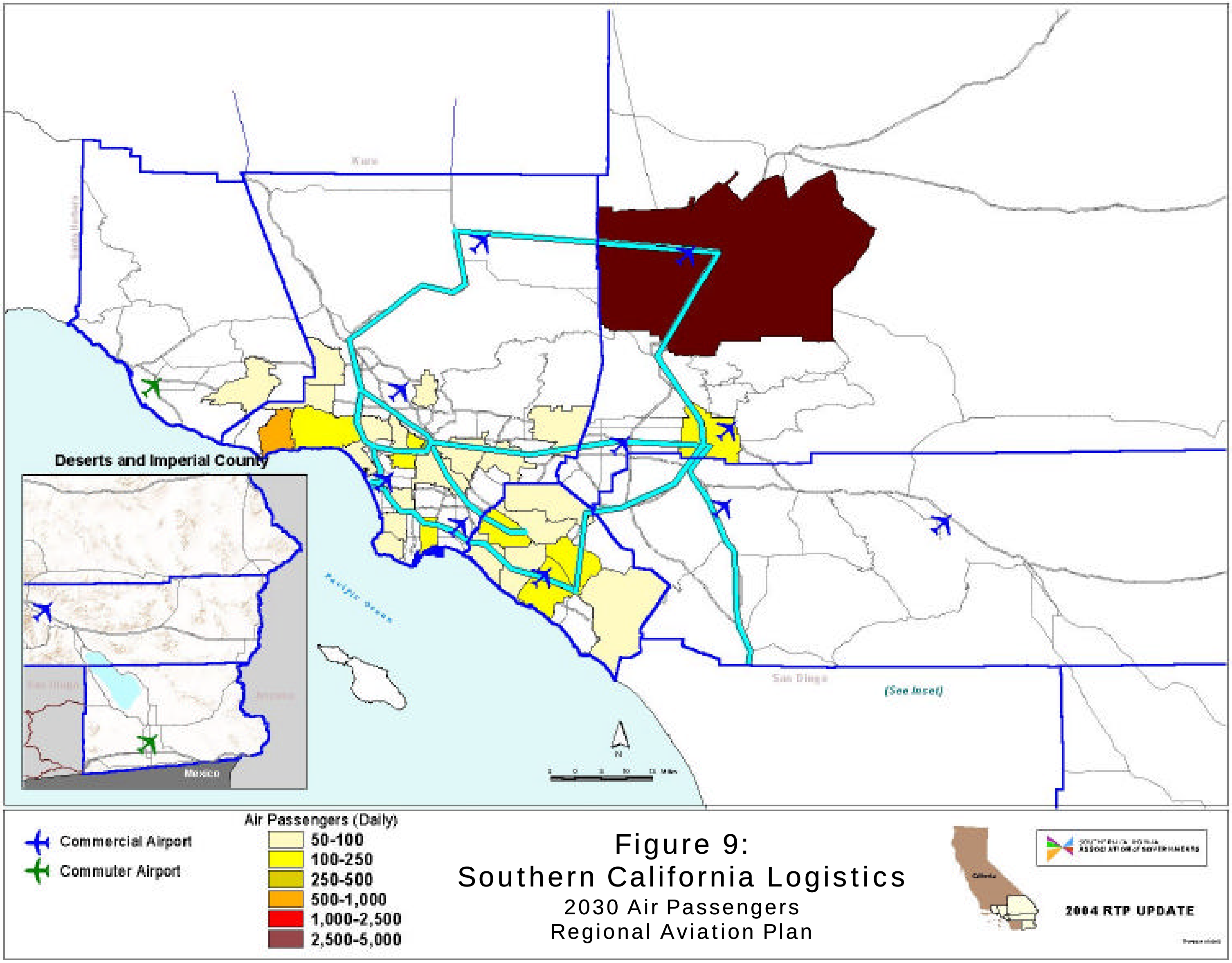

Figure 9:
Southern California Logistics
2030 Air Passengers
Regional Aviation Plan

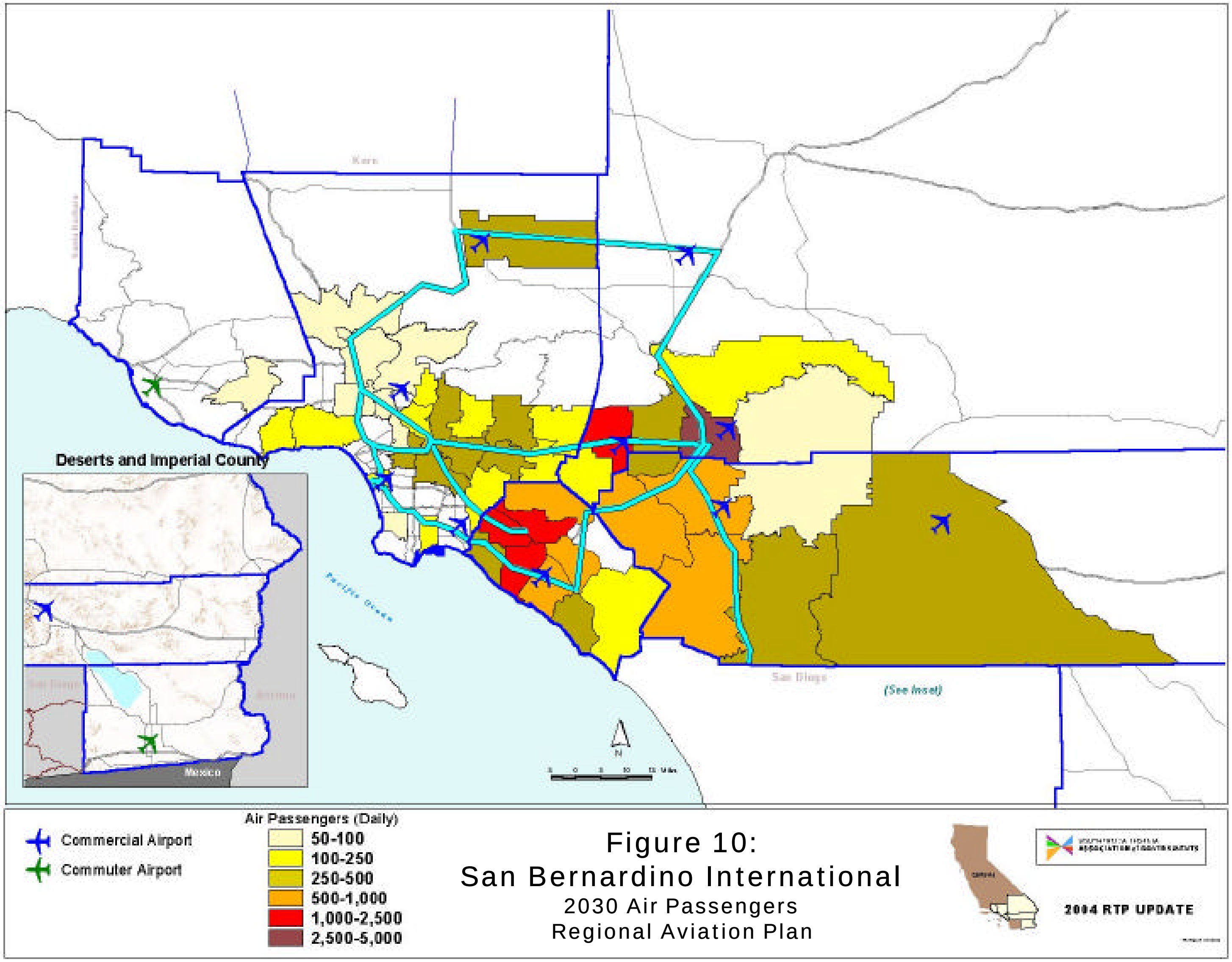

Figure 10:
San Bernardino International
2030 Air Passengers
Regional Aviation Plan

2004 RTP Update – Airport Ground Access

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2004 RTP Update – Airport Ground Access

1. Introduction/Purpose and Needs

In 2002 the SCAG Region had approximately 78 Million Annual Passengers (MAP). This total is almost double from the 1980 total. The level of air passenger demand is forecast to double again before year 2030.

Eight governing bodies hold responsibility for the planning of the ten commercial (air carrier) airports in the region, listed below.

Air Carrier – Commercial Airports for Year 2030	
Bob Hope (Burbank Glendale Pasadena) (BUR)	Ontario International (ONT)
John Wayne (JWA)	Palm Springs (PSP)
Los Angeles International (LAX)	Palmdale Regional (PMD)
Long Beach (LGB)	San Bernardino International (SBI)
March Inland Port (MAR)	Southern California Logistics (SCL)

Currently, six active commercial service airports handle the majority of passenger air traffic: Burbank, John Wayne/Orange County, Long Beach, Los Angeles International, Ontario International and Palm Springs. Limited commercial service also exists at Oxnard and Imperial County airports. Passengers are currently concentrated at the urban airports with LAX serving almost 72 percent of the regional total. This concentration of demand coupled with increased general (background) traffic demand and airport capacity limitations has produced access problems for passengers and cargo movements.

In an effort to address the competing issues of meeting the air demand needs in the Region, recognizing the traffic congestion near airports due to general traffic demand, and increasing air services closer to growth areas, SCAG has developed a 2030 Preferred Aviation Plan. At the heart of the Plan for the commercial air carrier airports, the demand of 170 MAP has been targeted at specific levels for the 10 airports as shown in the following table.

2003 and the 2030 Preferred Aviation Plan Air Passengers
(Millions of Annual Passengers)

	BUR	JWA	LAX	LGB	MAR	ONT	PSP	PMD	SBI	SCL	TOTAL
Existing Conditions (2003)	4.7	8.5	55.0	2.9	0	6.5	1.2	0	0	0	**78.9**
Preferred Aviation Plan (2030)	10.7	10.8	78.0	3.8	8.0	30.0	3.2	12.8	8.7	4.0	**170.0**

Future air carrier demand will be largely met by utilizing available capacity at suburban airports in the eastern and northern areas of the Region, to make up for capacity constraints at the urban airports. Four suburban airports with no existing air carrier operations, under the Preferred Plan, will growth to the approximately size of the existing MAP at Ontario International Airports. Cooperation between airport authorities is necessary to ensure efficient usage of this available capacity. Using the capacity promoted a decentralized system that relieves pressure on constrained, urbanized airports and the Region's surface transportation Infrastructure. Air cargo operations will be similarly decentralized under the Preferred Aviation Plan, as can be seen in the following table.

2003 and the 2030 Preferred Aviation Plan Air Cargo Demand (Thousands of Tons of Air Cargo)											
	BUR	JWA	LAX	LGB	MAR	ONT	PSP	PMD	SBI	SCL	TOTAL
Existing Conditions (2002)	43	15	1,958	58	0	547	0.8	0	0	0	**2,623**
Preferred Aviation Plan (2030)	87	43	2,340	137	1,117	2,252	128	1,024	1,092	504	**8,724**

The Preferred Aviation Plan attempts to distribute long haul and international service to suburban airports to the north and east of the dominant urban airports. Palmdale is one of the targets for this redistribution process. The Preferred Plan incorporates the proposed Maglev system, which will strategically connect the major airports and facilitate a balanced distribution of the aviation demand and services in the Region.

Without an operating Maglev system that connects various airports, residential areas, and other high-activity centers, the Preferred Aviation Plan would only serve a total of 155.0 MAP, or a loss of 15 MAP to the Regional system. The system would also lose 266,000 tons of air cargo.

This report analyzes and identifies the ground transportation improvements and costs that will be required to achieve an efficient airport ground access system for the 2030 Preferred Aviation Plan. Maglev costs (stations, parking and access issues) have been analyzed separately, in the 2004 RTP.

If the Preferred Aviation Plan is to become a reality, ground accessibility must not be a limiting factor in the efficient operation of the individual airports. Background traffic congestion will continue to grow, and impact several of the 10 commercial air-carrier airports. Therefore, some of the improvements are focused on freeways and interchanges. Other improvements are focused on arterial streets between freeways and airports. Additional improvements are internal to the airports, including roadways, parking, and transit facilities. These needed improvements, in many cases, must work with other projects already accounted for within the RTP. These include the regional Maglev system, freeway and interchange improvements, transit and other roadway projects.

The ground access projects identified in this report are separate into two categories, Phase I and Phase II. Phase I includes those projects in the 2004 RTP (i.e., Baseline, Tier 2, and Plan projects). Phase II projects are those that are needed for the efficient operation of these airports, but are beyond the current resources of the financially constrained 2004 RTP. Currently unfunded Phase II projects should be subject to further evaluation for potential inclusion in future RTP updates.

2. Approach/Methodology

2.1. Projects Needs Analysis and Selection

2.1.1. Introduction

The ground access projects for the 2030 Preferred Aviation Plan were modeled using the Regional Airport Demand Allocation Model, (RADAM) Version 9.11. This is the latest and most sophisticated version of the model that has been specifically configured to reflect changes that have occurred in the aviation industry and regional airport ground access since September 11, 2001.

The modeling addressed conventional ground access as well as the state-of-the-art regional Maglev system, the principal transit feature of the Preferred Aviation Plan. The Maglev system occupies the highest echelon on the airport ground access hierarchy, since it allows for the rapid movement of passengers from constrained urban to unconstrained suburban airports as a central component of the Preferred Aviation Plan's decentralization strategy. The ground access improvements are in addition to Maglev high-speed transit access to airports assumed in the Preferred Aviation Plan.

This ground access effort specifically focused on integrated modeling of the impacts of the Preferred Aviation Plan on future ground access infrastructure including Maglev. Therefore, the improvement projects specifically apply to the Preferred Aviation Plan and are not necessarily relevant or transferable to other airport forecasts.

Finally, the improvement projects were designed to enhance the airport system's ability compete with airports outside of the SCAG region. Enabling air passengers to access their flights in a timely fashion, in a region that faces rapidly increasing traffic congestion on a surface transportation system that connects suburban airports with urban population and employment centers, will be a daunting challenge. The ability to meet this challenge has enormous economic implications for the region--an efficient airport system will be an essential prerequisite for the region to participate in expanding national and global economies of the future. The ground access projects identified in this report, in conjunction with Maglev, were designed to insure the highest efficiency levels for the SCAG airport system as a gateway to domestic and international air passenger markets in the face of mounting ground access congestion.

Study areas were defined in coordination with SCAG staff for all of the existing and future airports. Study area boundaries were based on initial airport traffic projections[3] as well as on opportunities to develop effective improvement projects directly benefiting each of the airports in the Preferred Aviation Plan.

Although discrete study areas were delineated for each of the airports, the analysis did not exclude traffic generated by other airports sharing common roadways. To the contrary, the cumulative effects of all the airports in the system were reflected as additional traffic on shared infrastructure, including Maglev ridership.

[3] Review of airport traffic in similar airport modeling scenarios.

2.1.2. Summary of Access Project Needs Analysis and Selection Methodology

2.1.2.1. Integrated Approach to Airport Ground Access

Conventional ground access studies rely on a simple relationship between the existing MAP (million annual passengers) and traffic observed entering and leaving an airport. This number is then applied to the forecasted MAP level of a particular airport to yield future airport traffic in isolation from other airports in the system. This approach lacks the sophistication that is critical to accurately reflecting the vast spectrum of physical airport and behavioral air passenger attributes that affect ground access in an interactive multi-airport system. To overcome this obstacle, the Preferred Aviation Plan relied on an advanced configuration of the RADAM 9.11 Model for identifying roadway deficiencies and improvement projects.

The modeling of the Preferred Aviation Plan was based on a complex airport system and an intricate set of behavioral assumptions, which could not be addressed by statistically based models. Therefore, the ground access modeling utilized a model that integrates all aspects of airport operations from arriving aircraft (by aircraft type, engine type, seating and load factor), through the airport runways, gates and terminals, all the way to the nearest cross-streets comprising the passenger's final destination. In essence, this modeling combined airport passenger and truck forecasts with behavioral aspects of passengers, truck surveys, SCAG demographic and background traffic forecasts, and airport portfolios and flight schedules, to generate the resulting airport ground access impacts.

In contrast to individual airport traffic studies, the integrated methodology provides simultaneous modeling of air passenger and cargo traffic generated by all ten air carrier airports in a dynamically interactive ground access system. In this system, traffic from all ten airports competes for capacity of shared infrastructure. For example, traffic associated with SBI, ONT and MAR will simultaneously draw on the capacity of shared local freeways and arterials. Due to its projected size (78 MAP) and an exclusive long haul and international flight portfolio, LAX traffic also draws on the capacity of facilities serving other airports in the system.

Most importantly, the integrated approach to ground access allowed for an internally consistent evaluation of projects for all the airports using the same standards, interpretations and platforms for all model inputs and assumptions, including regional aviation forecasts, regional demographics, Maglev, and background and airport traffic. Thousands of modeling calibrations –needed to incorporate air passenger airport and mode choice behavior into the modeling process were based on extensive RADAM databases of over 300,000 domestic and international passenger surveys taken at all air carrier airports in the region since 1993.

One of the advantages of this integrated methodology is its high sensitivity for testing of projects from different perspectives. For example, modeling can quantify how a minor change in a load factor on a single flight, or a change in the ratio of business-to-non-business passengers on the same flight will individually and cumulatively affect traffic at a particular intersection at a given time. Or, conversely, how many passengers will be delayed by congestion at a certain intersection on their way to a specific flight and how that will affect the airplane's departure time and load factor. This sensitivity was highly useful for generating a realistic evaluation and ranking of improvement projects for all airports under the Preferred Aviation Plan.

Previous traffic studies and other information, such as ground counts, generated by local jurisdictions were reviewed. Various aspects of airport ground access were discussed with local officials and airport staff to obtain local input and perspectives

All of the assumptions regarding airport facilities and capacities, operational characteristics, market incentives, passenger attributes and high speed rail service to airports associated with the 2030 Preferred Aviation Plan were scrutinized and approved by the SCAG Aviation Task Force (ATF) and the Aviation Technical Advisory Committee (ATAC), in conjunction with technical workshops.

2.1.2.2. Approach to Airport, Background & Connecting Passenger Traffic

The modeling of the Preferred Aviation Plan began with RADAM databases containing a wealth of information on air passengers ranging from their current and historical propensities to fly, airport choice behavior, airport travel routes, historical travel patterns and high-speed train propensities, to regional and international air passenger origins and destinations.

2.1.2.2.1. Technical Approach to Traffic Assignment

In order to achieve consistency with SCAG's transportation planning, total regional traffic (combined airport and background traffic) was imported from the SCAG's regional model into RADAM for the year 2030. Airport trips were deducted from total traffic in the SCAG model to yield background or ambient traffic. This background traffic was then combined in the RADAM model with airport traffic stemming from the Preferred Aviation Plan.

As expected, traffic resulting from smaller airports in outlying areas (i.e. SCL) required little in terms of traffic redirection or re-assignment to alternate, less congested airport access routes. Generally, airport and background traffic integrated well without exceeding roadway capacities and the need for significant re-assignments to alternate routes. This is in contrast to urban airports with congested ground access, which required significant redistribution of both airport and background traffic in the face of unacceptable roadway overloads.

In conventional assignment models, all traffic (background and airport-related) is combined and generically redirected based on a simple re-calculation of exact passenger travel times from a local trip origin to a destination airport. Background and airport trips are treated exactly the same as they are re-assigned from overly congested roadways to alternative routes in an effort to reduce or equalize their travel times[4]. However, RADAM modeling for the Preferred Aviation Plan specifically accounted for behavioral differences between the various air passenger categories, and applied discrete re-assignment rules to each category.

Different re-assignment rules were applied to residents and non-residents, commuters and non-commuters, frequently flying residents taking short-haul flights, first-time international visitors, etc. This behavioral approach to modeling is necessary to achieve realistic results. For example, first-time international visitors tend to stay on major arterials and freeways providing the most direct access to an airport regardless of congestion, whereas frequently flying, resident business passengers often divert to more indirect routes to avoid traffic choke points. These discrete traffic re-assignments of air passengers, including specific redirection rules, were based on extensive RADAM surveys taken at all air carrier airports in the SCAG region.

2.1.2.2.2. Approach to Deficiency Analysis

In statistically based models, all trips generated by the various land uses are assigned to the roadways even if the roadways are already well over their physical capacity. This results in traffic volumes that are unrealistically high on certain freeways and arterials, often exceeding

[4] For the purpose of reaching a so-called "equilibrium assignment".

their physical capacity by more than 50%. In the Preferred Aviation Plan, the modeling shifted some background traffic overloads to alternate routes or off-peak periods, and shifted some background and airport trips to other modes of transportation such as Maglev. In some cases, it even suppressed some discretionary background trips[5] to avoid unrealistically high traffic to roadway capacity ratios.

2.1.2.2.3. Circuitous Airport Travel

Airport traffic is also compounded by another, often ignored phenomenon of air passengers, particularly visitors, getting lost on their way to or from an airport. In some cases, this is due to intuitively confusing roadway signage (i.e., US 101 North and South at the I-405/US 101 interchange[6]), and in other cases it is due to differences in urban topography compared to other cities, especially in the Far East and Europe. “Lost traffic” adds more indirect and circuitous trips to ground access. To be more realistic, the Preferred Aviation Plan simulated lost travel to airports through a technique called Asymmetric Logic. However, in the future it was assumed that improved airport signage, GPS and other onboard technologies will reduce, although not eliminate, “lost traffic”. The regional Maglev system will eliminate some lost travel in the vicinity of airports with direct and convenient connections to airport terminals.

2.1.2.2.4. Route Reliability Approach

Maglev’s superiority lies in its ability to deliver passengers on time to all airports regardless of congestion or roadway closures and is therefore critical to the generation of the high passenger demand at suburban airports, compared to forecasts under the Constrained Alternative without Maglev. For example, PMD (forecast of 12.7 MAP in 2030) is served by a single freeway (SR-14) from the south. Should the freeway suffer from significant congestion, as projected, or high closure rates (due to accidents), this would increase Maglev ridership to PMD, but lower PMD’s overall passenger forecast, since not all passengers would shift to Maglev. Therefore, the Aviation Task Force approved the assumption that necessary improvements would be made to SR- 14 to boost its “route reliability” status in the Preferred Aviation Plan.

2.1.2.2.5. Connecting Passenger Ground Access Impacts

In conventional ground access studies, connecting passengers are often assumed to remain at the airport and are not accounted for in ground access. The modeling of the Preferred Aviation Plan used RADAM surveys to reflect air passengers who temporarily leave the airport for hotels, restaurants and other local attractions using conventional ground access such as hotel shuttle vans. Furthermore, the modeling showed that more connecting passengers would leave airports by Maglev and then return for their scheduled departure, taking advantage of Maglev’s precise schedule and predictable, on-time performance. These additional Maglev trips were also reflected in the Maglev ridership.

Behavioral RADAM modeling also showed that some connecting passengers would extend their stay by catching later flights, with more flights available at future airports under the Preferred Plan, in order to visit local destinations, thereby contributing to local economies.

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[5] According to survey data.
[6] Intuitively, US 101 runs east and west through the Fernando Valley, while I-405 runs north and south.

2.1.2.2.6. On-Site Traffic Surveys

Baseline traffic conditions of airport and background traffic were established based on on-site field surveys using uniform methods and standards for all study areas for the same time periods, as opposed to differentially collected, and sometimes outdated, information from various sources.

Ground counts of combined airport and background traffic were compared with regional model outputs for existing conditions. Differences between actual counts and the Regional Transportation Model outputs were noted and accounted for in the modeling of future background traffic conditions. A number of trip generation counts were also taken at selected land uses (i.e. shopping centers) to develop more realistic background traffic. Selected roadways, intersections and freeway segments were digitally recorded to provide visual augmentation to computer simulations.

2.1.2.3. Technical Summary of the Modeling Sequence

Passengers are generated for each passenger cluster (passenger origin or destination identified by nearest cross streets, 3,200 total in the SCAG Region) based on RADAM surveys, perceived travel times to airports and SCAG demographic data. Air passengers are then allocated to airports based on meeting their expressed travel needs with the combination of airport attributes at each airport such as airport portfolios, available flights, etc. The initial airport attributes are incrementally refined to accommodate specific passenger demands within constraints imposed by the Preferred Plan assumptions (i.e. LAX at 78 MAP). Once these refinements are made, specific flights are developed in accordance with the airport system assumptions. Flights are scheduled based on passenger demand, and physical airport parameters (gates, taxiways runways, etc.) consistent with the assumptions approved by the Aviation Task Force.

For arriving passengers, aircraft types, load factors, arrival times, and processing through the terminals (including security, immigrations/customs, etc.) are used to determine when they will embark on the ground access portion of their journey. For departing passengers, discrete time-before-departure characteristics (from the survey database) are used to determine when the different passenger categories (resident, non-resident, etc.) leave for different types of flights (i.e. commuter, short haul). Ground access trips are then generated for each arriving aircraft by passenger category, mode choice and destination within or outside of the region. Truck traffic is based on allocations of tonnage to airports for several air cargo categories (express, freight, mail, e-commerce). Truck traffic is subsequently merged with other traffic (through passenger-car-equivalent/PCE methods).

Air passenger assignments are based on historical RADAM surveys of routes typically taken by the different passenger categories (i.e., business and pleasure) for different types of flights (by haul type) during peak and off-peak hours. For example, assignments for business passengers going on commuter flights are different from all-inclusive tour passengers going on international flights during peak hours. In addition, assignments are based on routes that were historically favored by passengers going from specific RADAM zones to different airports. Truck assignments are also based on surveys of historical truck travel patterns and take into account differences in truck type and cargo category.

Passenger trips compete for roadway capacity with background and truck traffic. Different categories of air passengers are either retained or diverted from overloaded roadways based on discrete rules. Background trips are re-assigned according to different rules than air passenger or truck trips. Some background traffic is dynamically shifted to alternate routes, to off-peak periods, to other modes of transportation, or in some cases, it is suppressed to avoid unrealistically high overcapacities. Capacity deficiencies are noted and improvement projects developed based on standard engineering methods (ICU's, v/c ratios, etc.) The entire package of projects is then tested to insure that ground access does not cause unacceptable delays to flights, or more importantly, do not change the adopted MAP forecasts for the ten airports.

2.1.2.4. RADAM Maglev Model Methodology

2.1.2.4.1. Maglev Partnership Model

The ground access mode choice is based on a two-fold process, with separate modeling streams for Maglev and conventional ground access. Maglev allocations are not simply shares of total trips, as is the case with conventional models. In these models the total number of trips is run through several mode choice equations, which incrementally split the total number of trips into different modes of transportation such as Maglev. This methodology lacks sufficient sophistication to reflect the unique generation characteristics of Maglev ridership. Surveys of over 126,000 high-speed rail passengers (taken on TGV, ICE and Japanese high-speed-rail systems) confirm that Maglev ridership is based on a wide range of behavioral attributes, which cannot be addressed by conventional mode choice models by simply splitting a fixed number of total trips into several categories. Therefore, the RADAM Maglev Model is a separate, or a so-called "partnership model", nested within the overall model architecture where it works in tandem with the rest of the models, rather than as a subordinate model. Because it is a "partnership model", it can be run independently from the RADAM airport, traffic, and economic models. In that capacity, it features its own generation, distribution, and passenger allocation functions (as well as a non-airport passenger allocation function). After being generated, Maglev ridership is then merged with conventional mode choice distributions to produce a more realistic replication of the behavioral aspects of Maglev ridership.

2.1.2.4.2. Maglev Effects on Land Use

As a major transportation advancement, Maglev will significantly impact land use and development due to its superior airport accessibility, on-time performance, reliability, comfort and ability to reach speeds in excess of 180 mph. Companies that rely on air transportation will locate closer to Maglev stations and alignments for reliable and efficient access to airports in the face of mounting regional highway congestion. This will increase Maglev ridership propensities around Maglev facilities. Therefore, land use modeling is a significant function of the RADAM 9.11 model, which generates "catalytic land use configurations" in the vicinity of Maglev stations and alignments. These configurations are specifically quantified in terms of modified population and employment forecasts (by general sic code) for zones around Maglev stations and alignments. A variety of different catalytic land use configurations can be generated in conjunction with existing and future land use patterns. However, the modeling of the Preferred Aviation Plan used the Preferred Plan Forecast for socio-economic input into RADAM and did not specifically address land uses in the vicinity of Maglev stations and alignments.

2.1.2.4.3. Maglev Ridership Generation

In conventional models, Maglev ridership is a simple percentage of a fixed number of total trips based on factors such as comparative costs with other modes of transportation and trip lengths. In the modeling of the Preferred Aviation Plan, Maglev ridership was generated from the "bottom up" based on passenger propensities for Maglev ridership derived from an extensive survey database[5]. The generation of Maglev passengers is based on 97,000 surveys in Southern California, identifying historical as well as current propensities for Maglev ridership for 3,200 traffic analysis zones (TAZ's) in the SCAG region. This geographic delineation insures consistency with SCAG's demographic and traffic forecasts, which are based on the same zone system. Maglev ridership is generated through unique equations for each TAZ or selected conglomerations of zones sharing similar attributes. Unlike conventional models, the generation phase of RADAM distinguishes between baseline, induced and catalytic Maglev passenger demand. The modeling of the Preferred Aviation Plan used factors such as route reliability assumptions[6], integrated airfare/Maglev pricing, perceptions of congestion and travel times as well as sensitivities to on-time performance to more realistically project behavioral attributes affecting induced Maglev ridership. Catalytic passenger demand was reflected in increased Maglev ridership propensities around Maglev stations and alignments.

2.2. Ground Access Projects

2.2.3. Ground Access Project Development Process

Projects developed for each of the study areas were based on a number of considerations. However, the overriding goal of these projects was to improve airport access to the highest degree possible to insure high efficiency of the proposed 2030 decentralized airport system and its competitiveness with airports outside of the SCAG region.

The modeling of the Plan generated air passenger trips for several passenger categories (e.g. business, non-business, inclusive tours, resident, non-resident and part-time resident passengers). Air cargo trips were also generated for different cargo categories including general freight, express, e-commerce, as well as Maglev cargo (express and high-value cargo). Traffic flows generated by the various passenger and cargo trips were used individually and cumulatively to identify roadway capacity deficiencies. The already funded, Baseline projects were included in the 2030 roadway system. The identified improvement projects are in addition to Maglev assumed in the Preferred Aviation Plan.

2.2.4. Approach to Capacity Deficiency Modeling

Projects were based on standard traffic engineering methods and criteria including intersection capacity utilization (ICU), mid-block v/c ratios (as generated the SCAG Transportation Model), freeway weaving area analysis, interchange ramp analysis, passenger-car-equivalents for truck traffic as well as refined (level of service) airport parking demand analysis. Essentially, all these techniques examined the relationship between the forecasted traffic volumes and nominal roadway capacities. The capacities for different roadway categories used in the modeling are consistent with SCAG's regional transportation model.

[5] Germany: 30,000 air passenger surveys, 15,000 on ICE passengers; France: 37,000 air passenger surveys, 22,000 surveys of TGV passengers; Eastern Europe: 20,000 surveys of potential passengers, 15,000 surveys along proposed Maglev /HSR alignments; Mexico: Guadalajara and Rodriguez Field 15,000 air passenger surveys; Japan: 59,000 air passenger and HSR surveys; Ongoing survey of Maglev passengers in China; Domestic: 97,000 air passenger surveys in So. California.

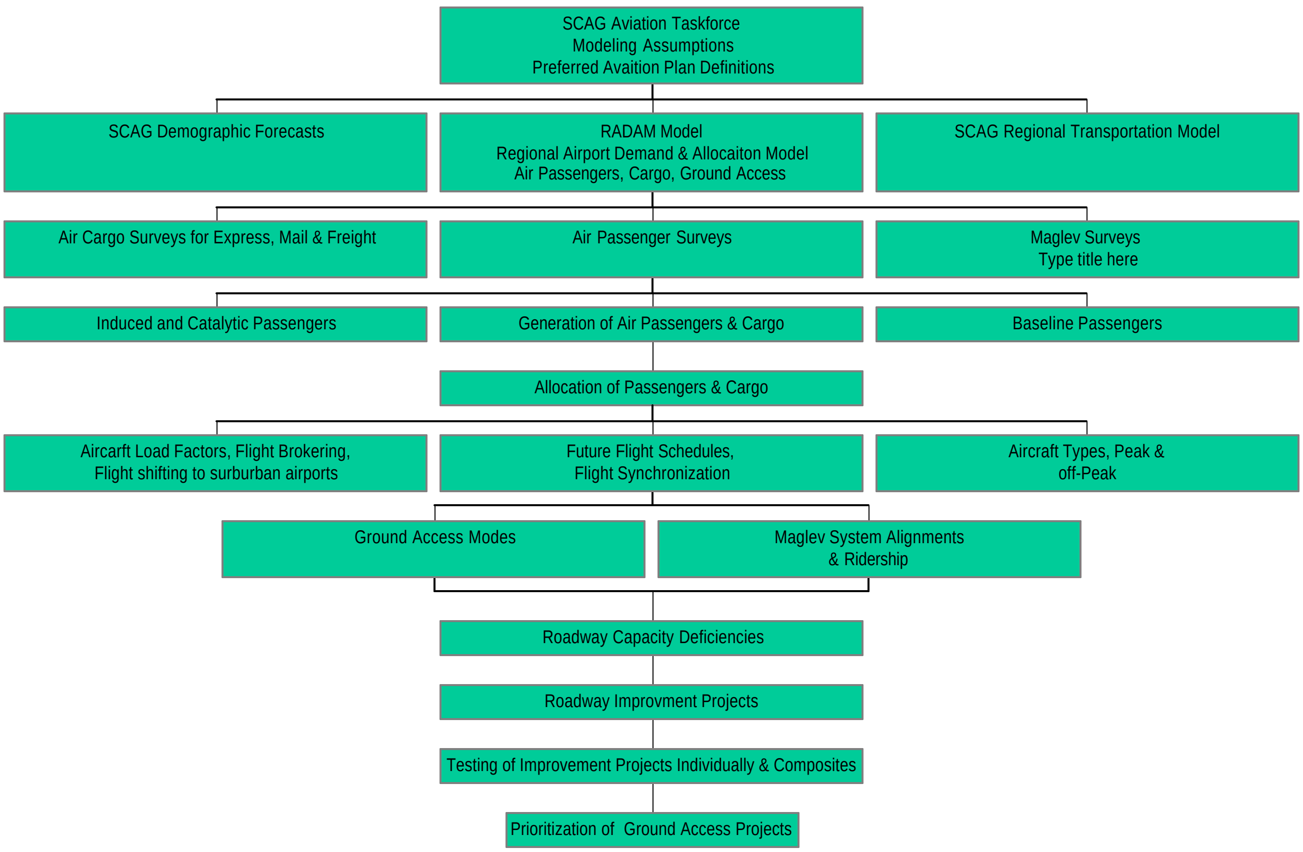
[6] As a measure of unexpected freeway closures due to accidents, and high fluctuations in congestion.

Efforts were also made to mitigate congestion in the vicinity of airports by providing alternate routes for background and through traffic. For, example, improvements on Imperial Highway would help channel some northbound traffic away from LAX by providing an alternative route to Playa Vista. This would help in reducing congestion on Sepulveda Blvd. in the vicinity of LAX, including the Sepulveda Tunnel. In another case, the Empire Interchange project would help relieve future congestion on Hollywood Way in the Bob Hope Airport study area.

The development of projects for the ten airports was facilitated by the synchronized modeling of airports, flight schedules and Maglev in conjunction with conventional ground access. In synchronized modeling of several airports in the system, ground access times are an important factor affecting airport forecasts in terms of air passenger and cargo demand. Consequently, major ground access improvements could reduce travel times to certain airports and make them more attractive to passengers and cargo. This would result in increased forecasts for airports with substantially improved ground access and reduced forecasts for the remaining airports with fewer ground access improvements. Since the Aviation Task Force adopted specific airport forecasts, as well as the regional total of 170 MAP, the improvement projects were balanced to insure consistency with these forecasts and the regional total in the Preferred Aviation Plan.

Improvement projects were developed based on (a) severity of capacity deficiency as expressed by volume/capacity ratios; (b) effectiveness in alleviating congestion on principal ground routes; (c) ability to relieve background and through traffic to free up capacity for air passenger and air cargo truck traffic; and (d) ability to forestall the loss or diversion of passengers and cargo to other competing regions.

Overview of Ground Access Project Identification and Selection Process



2.3. Cost Estimates

Once ground access needs were identified for each of the 10 airports, all projects were sorted by airport and project type. Three project type categories were established:

1. Internal Circulation, Transit Facilities, and Parking
2. Arterials
3. Freeways and Interchanges

Projects were then compared against the RTIP and RTP. They were examined to see if part or all of the projects were already in the RTP. Cost estimates included in the RTP or RTIP were also reviewed, if they existed. Projects were classified into two groups:

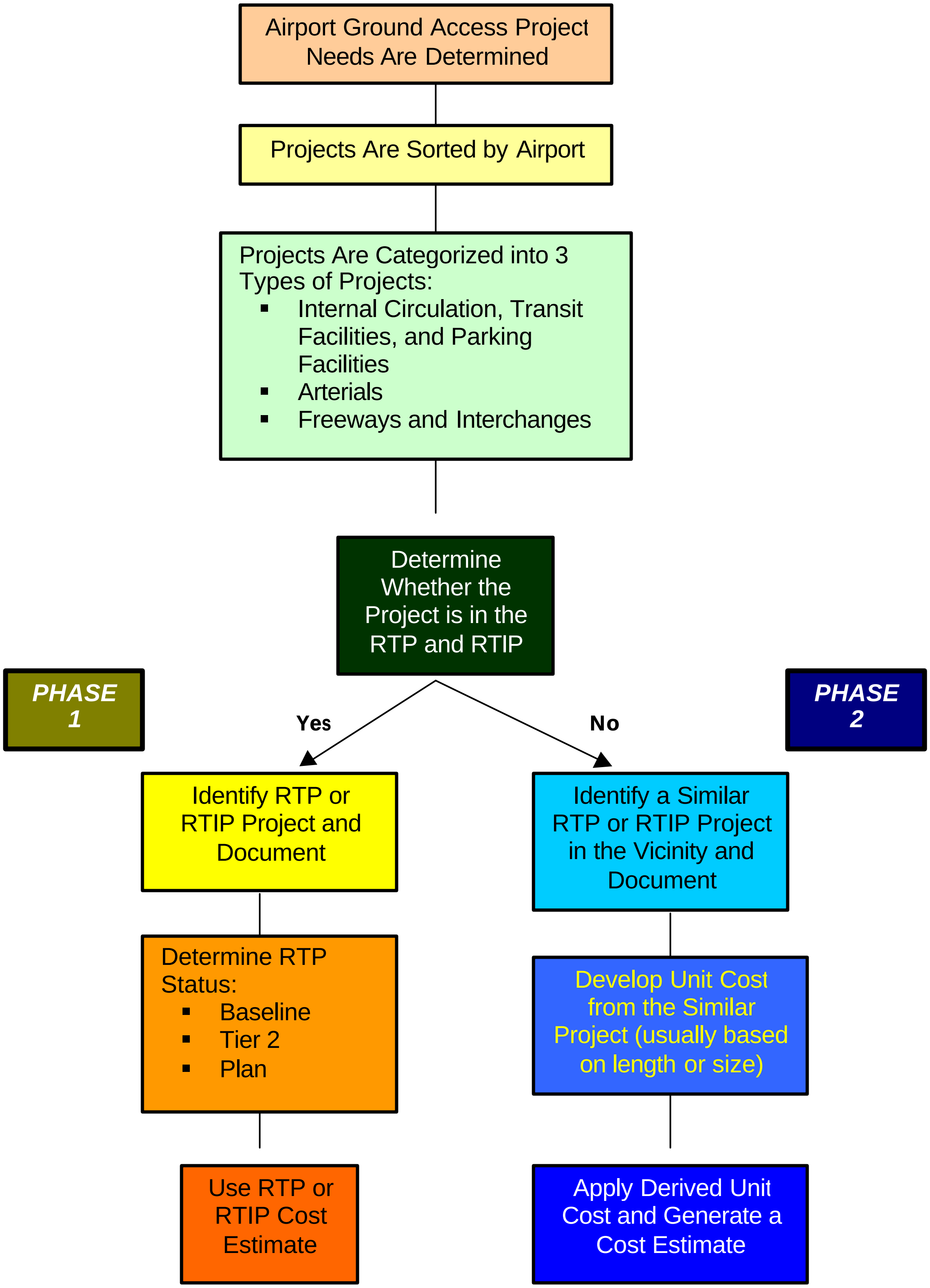
- Phase 1 – Funded, included in the RTP (Baseline, Tier 2, and Plan)
- Phase 2 – Unfunded, not included in the fiscally constrained Plan

The cost estimate for these projects came from the RTIP and/or RTP, if estimates were listed. Their status within the RTP was documented. These projects were collectively denoted as Phase 1.

For the remaining projects, very similar projects in the immediate vicinity of each project used to derive a unit cost. Such projects at each airport were, therefore, based on nearby RTIP or RTP project cost estimates. Where this process was used, the “similar project” was documented. In most cases, the derived unit cost was based on the length of the project. In some cases, the cost per lane mile was derived and applied to the Airport Ground Access Project. These projects were collectively denoted as Phase 2.

All costs were in Year 2002 dollars.

Flow Chart for the Cost Estimating Process for Airport Ground Access Projects



3. Existing Conditions, Future Conditions, and Ground Access Projects

3.1. Current and Future Regional Ground Access Issues

Under current conditions, airport ground access in the SCAG region is characteristically congested during rush hours as most freeways suffer from moderate to severe congestion. This type of congestion is difficult to manage through conventional mitigation measures due to funding limitations. This situation is not likely to reverse or improve by the RTP planning horizon year of 2030. RADAM modeling shows that freeway congestion will make air travel more inconvenient in the future and, in some cases, even impractical for some air travelers. However, modeling also shows that this situation could be partially mitigated through significant transit measures in the form of Maglev. Unlike the future freeway system, Maglev offers precise departure and arrival times and unparalleled on-time performance.

A significant future ground access issue will be a more congested freeway system with limited, failing capacity in the face of overwhelming intra-, and inter-regional demand for travel. This trend will continue to exert an inhibiting force on the decentralization of aviation services in the region. Furthermore, numerous studies have demonstrated that even very substantial increases in freeway capacity will only draw more traffic and not necessarily alleviate congestion during rush hours. The modeling showed that in the future, rush hours will spread more throughout the day, making airport access more difficult and air travel less practical. SCAG planners therefore concluded that an effective decentralization of air service is only feasible through the technological upgrade to a regional high-speed Maglev system. This was underscored by substantial differences in suburban airport forecasts between the Constrained Alternative (without Maglev) and the Preferred Aviation Plan with the regional Maglev system.

At 78 MAP, LAX ground access will continue to affect the overwhelming majority of air passengers in the region and should be the focus of immediate short-, and long-term mitigation planning actions. However, in order to draw passengers to suburban airports, the Preferred Aviation Plan was based on the assumption that ground facilities and parking at outlying airports would be significantly improved to successfully compete with the established urban airports. As such, the improvement projects for future suburban airports include new construction of airport facilities (including internal airport circulation), as well as the upgrading of existing ground access infrastructure as an incentive for the decentralization of air services under the Preferred Aviation Plan. Local ground access improvements will be needed for suburban airports to efficiently serve passengers in their local service areas, (i.e., Ontario efficiently serving passengers in the growing Inland Empire).

Many projects identified in this process are currently part of the Regional Transportation Plan (RTP) Update for 2004. The identification of an individual project's RTP status can be found in Attachment A at the end of this report.

3.2. Los Angeles International Airport (LAX)

In the 2030 Preferred Aviation Plan, the Los Angeles International Airport is constrained to 78 MAP in an effort to decentralize air service throughout the region. LAX is served by Maglev connecting it to ONT and Orange County.

Map of LAX and Environs

Under the 2030 Preferred Aviation Plan, LAX was modeled to serve 78.0 million air passengers (MAP) with emphasis on international service. Short haul and medium haul service was decentralized to other airports via Maglev including ONT, SBD, MAR and PMD.

Under the 2030 Preferred Aviation Plan, the domestic passenger demand of 39.1 MAP will be comprised of 4.99 MAP (commuters), 11.73 MAP (short-haul), 11.38 MAP (medium-haul), and 10.99 MAP (long haul). Due to the emphasis on international service, the origins and destinations of ground access trips will differ from the origins and destinations of domestic commuter and air carrier passengers.

3.2.1. Existing Ground Access

The major access arterials to LAX are Century, Sepulveda, Imperial, Lincoln, Aviation and La Cienega. LAX is also served by the I-405 and I-105 freeways.

On an average day, Century between I-405 and Sepulveda is uncongested (v/c ratios .4-.67) and most of its intersections operate at acceptable levels of service. However, during the peak travel season, the major Century intersections at Airport, Aviation, 98th Street, Jenny and La Cienega exceed capacity (v/c ratios of .95-1.35). Traffic from I-405 southbound to Century westbound saturates the I-405 off-ramp at La Cienega, with queues building upstream on I-405.

The downstream intersection of La Cienega and Century also exceeds capacity and with queues backing up to the La Cienega off-ramp. This configuration is problematic, although it is generally uncongested during off-peak hours in the off-peak season. Century serves both direct airport access as well as local access traffic generated by major hotels and abutting businesses.

In contrast, access to LAX from the north on Lincoln is excellent. The expressway-like configuration of Lincoln, north of the runways, allows for high speeds even during peak periods. Congestion increases as Lincoln approaches Manchester.

Peak season traffic on I-105 is congested at the westbound I-105 to the northbound Sepulveda off-ramps. The resulting queues back up on I-105. In addition, the off-ramps discharge freeway traffic at a point just south of the Sepulveda Tunnel, compounding tunnel congestion. As a major north-south arterial, Sepulveda carries a large share of through traffic. Due to peak hour congestion on I-405, some north-south traffic diverts to Sepulveda thereby increasing demand. This is not a problem for the high capacity portions of Sepulveda, such between Century and Lincoln, but poses a dilemma for the tunnel.

Manchester currently operates at reasonable levels of service, except during peak hours in the peak season. La Tijera is for most part uncongested and provides an alternate route to taking the Century exit to LAX.

The ground access problem at LAX is caused not so much by airport traffic, which has not been increasing in the last few years, but by freeway congestion (v/c ratios of .95-1.27). Many passengers seek and divert to alternate routes to avoid congestion on I-405 during peak periods.

It is also important to note that large airports such as LAX generate less traffic per origin/ destination passenger than smaller regional airports. The latter are generally accessed by auto with lower auto occupancy rates. In contrast, larger hub airports generate far less traffic due to greater representation and use of high occupancy vehicles such as shuttle vans. Therefore, the growth of LAX from its current passenger demand to 78 MAP will not necessarily translate into proportionally higher airport traffic. In fact, empirical data collected at LAX suggests that as congestion increases and travel times become less predictable, air passengers seek out other more reliable modes of transportation generating higher vehicle occupancy rates.

3.2.2. Future Ground Access

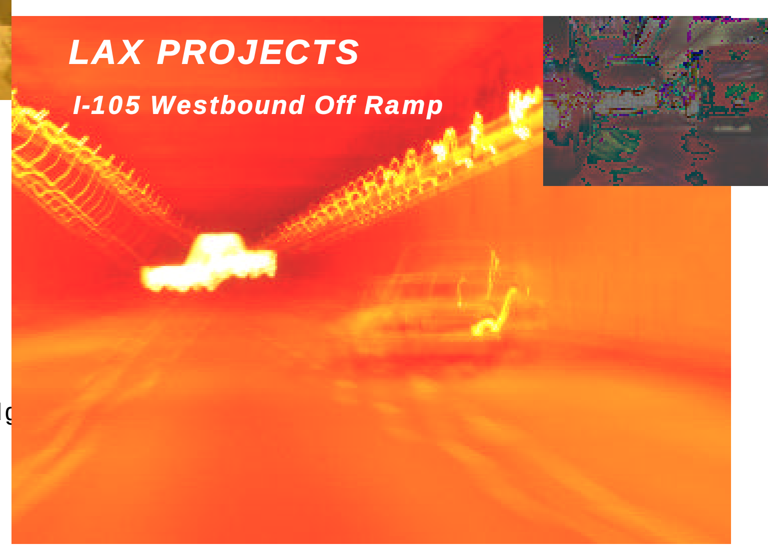
Future ground access conditions at LAX will be characterized by severe freeway congestion spilling over to off-peak periods, as well as growth in background traffic on major through arterials. As LAX approaches the 78 MAP constraint, its traffic generation rate per air passenger will decline. In addition, improved light rail access (Greenline) and new Maglev access will help reduce traffic on freeways (as well as increased high-occupancy vehicle use stimulated by an expansion of the FlyAway park-and-ride system). Light rail and Maglev access will also help to alleviate local congestion in the vicinity of LAX, although they are not primarily designed to do so. Local congestion alleviation can be primarily accomplished through an efficient ground access center and people mover system, in conjunction with complementary local ground access improvements. While several LAX master plan alternatives have been meticulously studied, a final master plan alternative is not yet available.

LAX is also an acreage-limited airport with much of its activity occurring within a very limited amount of space, as compared to other international hubs. In that sense, it is a highly efficient airport. Its future traffic distribution will depend on the degree to which airport operations will be contained in the eastern part of LAX and how much may eventually shift to the less utilized westside. This can affect demand on Imperial and Pershing, which could then see a significant increase in traffic and require additional projects.

Century will be congested throughout the day during peak seasons (v/c ratios of 1.23 to 1.35). To alleviate capacity deficiencies it should be upgraded to a 10-lane configuration with additional turning lanes from the Central Terminal Area to I-405, resulting in improved traffic flow (v/c ratios of .95-1.1). To reduce congestion, two additional turning lanes at Aviation and Airport will also be required (peak period v/c ratios .8-.95). Century is projected to carry a moderate to high percentage of airport traffic.

Sepulveda will suffer from severe congestion from Manchester to the southern limit of the study area, which will be compounded by congestion on Rt. 105 (v/c ratios 1.8+). This will require extensive widening of Sepulveda (from Manchester to El Segundo, except for the Sepulveda Tunnel[7]), and the reconstruction of the I-105 westbound to Sepulveda northbound off-ramps to three lanes plus an emergency lane. This should be accompanied by the reconfiguration of Sepulveda southbound to Imperial westbound off-ramps to a 3-lane standard, plus an emergency lane and a widening of Imperial to a continuous three-lane configuration from I-405 to Del Mar.

Due to severe congestion on Sepulveda, Imperial and Pershing will serve as alternate routes to Playa Vista. The Imperial/Pershing intersection will also need to be upgraded, especially if some airport activity is shifted to the west side (peak period v/c ratios of .8-1.1). This will facilitate some relief for the Sepulveda Tunnel. Sepulveda will carry a moderate percentage of airport traffic.



Due to the planned future location of major transportation centers as well as increased congestion, Arbor Vitae and Aviation will need to be widened to four-lanes in each direction. La

[7] Widening of the tunnel would substantially increase budg

Cienega will need to be upgraded to a six-lane configuration from Arbor Vitae to Imperial resulting in reduced congestion (v/c ratios of .78-.82). The south half of the interchange on Arbor Vitae will need to be constructed in Inglewood. Arbor Vitae will carry a moderate percentage of airport traffic.

Additional improvements beyond the study area will also be necessary.

3.3. John Wayne Airport (JWA)

In 2030, John Wayne Airport[8] is forecast to reach 10.8 MAP, comprised of 10.34 million domestic and 0.46 million international passengers.

JWA is projected to be a passenger airport with a modest air cargo forecast of 43,090 annual tons in 2030.

3.3.1. Existing Ground Access

The major arterial access routs to JWA include MacArthur, Michelson, Von Karmen, Campus and Jamboree. The airport is encompassed by I- 405 to the north, SR- 55 to the west, and SR-73 to the south.

McArthur, a major high capacity arterial, is currently uncongested throughout the day (v/c ratios of .51-.7). Traffic further south, in the vicinity of SR-72 increases during peak periods. At the junction with I- 405, traffic on McArthur increases as the freeway suffers from recurrent congestion.

[8] FAA code SNA

Map of JWA and Environs

Michelson is more congested during peak periods (v/c ratios of .87-93) at McArthur, which serves as the entry point to JWA. Further east, Michelson is less congested at Campus and operates under capacity.

During peak periods, mobility on Von Karmen declines at its intersections with Michelson and Jamboree.

Campus, a major arterial, provides access to JWA from Newport Beach and the University of California, Irvine. At the intersection with McArthur it is generally uncongested (v/c ratios of .5-67).

Jamboree parallels JWA to the east and provides a connection between I-405 and SR-73 to the south. Jamboree is uncongested, but during peak hours it approaches capacity at I-405 (v/c ratios of .5-.77).

The major problem with JWA access is recurrent, severe congestion on the surrounding freeway system. The El Toro "Y" located to the south of the airport affects ground access during peak periods.

3.3.2. Future Ground Access

The future forecast for JWA is 10.8 MAP representing a modest growth from its current passenger levels. As such, ground access to JWA will not be impacted by a major increase in airport-generated traffic but by background traffic, especially on the surrounding freeways. While congestion on arterial ground access to JWA can be mitigated condition, its freeway access will pose a major challenge and require mitigation. Unlike other airports, the Maglev station will be located at the Irvine Center and not generate additional traffic in the immediate vicinity of JWA.

Peak hour traffic on McArthur is projected to approach and exceed capacity, especially at the interchange with I- 405 (v/c ratios .88-1.22). Congestion will back up toward Michelson and require one additional lane in each direction on McArthur (from I-405 to Michelson) to restore mobility (v/c ratios of .6-.71). Consequently, the intersection with Michelson will be overcapacity during the PM peak hour (v/c ratios .9-1.15). As the major access point to JWA, this will require special attention and mitigation by upgrading the Michelson/MacArthur intersection (v/c ratios of .77-85). Michelson will also need to be widened by one lane in each direction from MacArthur to Von Carmen. The ingress point to JWA, starting west of the MacArthur/Michelson intersection will need to be modified to accommodate increased air passenger traffic. Macarthur will carry a very high percentage of airport traffic.

The Von Karmen over crossing will need to be modified to alleviate peak period congestion (v/c ratios of .8-1.1).

Campus will become congested during peak hours especially in the vicinity of the University of California at Irvine (v/c ratios .9-.97). However, this is contingent upon future circulation within the university. It will carry a low to moderate percentage of airport traffic.

Jamboree will be congested at the I-405 interchange (v/c ratios in excess of 1.43) and will require a modified interchange. Southbound auxiliary lanes from MacArthur on-ramp to Jamboree interchange to Culver Drive off-ramp will be needed to alleviate congestion. An additional southbound off-ramp and a northbound on-ramp on I-405 at Irvine Center Dr. will be required. Jamboree will carry a low percentage of airport traffic.

However, the main focus of future deficiencies will be on the surrounding freeway system. To alleviate these deficiencies will require one additional lane in each direction on I-405 (from Bristol to SR-133) plus auxiliary lanes and the Bristol/I-405 interchange upgrade.

SR-72 will suffer congestion (v/c ratios of 1.11 –1.57) and require mitigation by adding one lane in each direction from Jamboree to SR-55 and an auxiliary lane from Birch to SR-55. HOV lanes will be required on SR-55 in each direction, as well as a northbound ramp and westbound right-turn lane on Paularino at SR-55. The interchange of SR-55/I- 405 will need to be upgraded for transitway improvements.

Access to the planned Maglev station will need to be improved by an upgrade of the San Canyon/I-405 interchange. Overall, the I-405, SR-73 and SR-55 will carry a low percentage of airport traffic.

3.4. Ontario International Airport (ONT)

In the 2030 Preferred Aviation Plan, the Ontario International Airport is forecast to reach 30.0 MAP as part the decentralization strategy[9], including planned Maglev access, and an increased demographic forecast (Preferred Plan Forecast) for the Inland Empire. This forecast far exceeds the current demand at ONT. This is due to the fact that in the decentralization strategy (Preferred Aviation Plan) ONT will receive large volumes of 2030 regional air passenger demand that cannot be served by LAX (constrained to 78 MAP).

Map of ONT and Environs

Under the 2030 Preferred Aviation Plan, the domestic passenger demand of 24.85 MAP will be comprised of 1.9 MAP (commuters), 11.93 MAP (short-haul), 6.46 MAP (medium-haul, and 4.56 MAP (long haul). ONT is also forecast to carry 5.15 MAP international passengers.

9 Part of the "flight brokerage system" modeling assumption.

ONT will function as a major air cargo airport with an allocation of 2.25 million tons of air cargo in 2030.

3.4.1. Existing Ground Access

Major ground access arterials serving ONT include Archibald, Vineyard, Grove, Haven, Milliken, Holt, and Airport. The airport is encompassed by I-15 to the east, I-10 to the north and SR-60 to the south.

Archibald, the main access route to ONT, is a high capacity major arterial and operates well below its capacity (v/c ratios of .3-.48). However, during peak periods, traffic increases, particularly at the I-10 interchange. South of the airport, Archibald is uncongested (v/c ratios of .13-.41). Jurupa, which connects to Archibald south of ONT, has similarly low traffic. At the I-10 interchange Archibald is subject to congestion stemming from high traffic demand on I-10 during the AM and PM peak periods. Archibald is part of the well-designed, high capacity ONT ground access system.

Haven, east of ONT shows greater congestion than Archibald due to increased through traffic (v/c ratios of .7-.78). It becomes more congested in the vicinity of the I-10 interchange during the AM and PM peaks. The same applies to the SR-60 interchange.

Vineyard is uncongested as there is little traffic accessing the old terminal facilities. North of I-10, Vineyard attracts more traffic but still operates at an excellent level of service throughout the day.

Grove is located to the west of the airport and operates at acceptable levels of service (v/c ratios of .57-.66). However, traffic increases in the vicinity of Holt.

Milliken carries high truck traffic volumes with increased demand for capacity at its intersections just south of I-10 (truck stops). It is a high capacity major arterial and operates at an acceptable level of service.

Holt provides a diagonal connection from I-10 to Vineyard. It is generally not congested, however, some congestion occurs at the Grove/Holt intersection.

The major difficulty with ONT ground access is primarily related to recurrent peak period over-capacity conditions on I-10 (v/c ratios 1.10-1.23) and on SR-60 south of the airport (.89-1.12).

Although many of the north/south arterials are uncongested, the interchanges with these freeways cause ground access problems for ONT.

3.4.2. Future Ground Access

Airport Drive, a major arterial north of the terminal, is part of an extensive ONT ground access system, designed to efficiently serve airport circulation. This system will insure smooth traffic operation for many years to come. However, additional ground access improvements will be necessary with ONT reaching 30 MAP in the 2030 Preferred Aviation Plan.

Archibald will receive high volumes of traffic from ONT under the Preferred Aviation Plan. Even though Archibald is a high capacity arterial, traffic generated by the 30 MAP forecast will cause it to reach capacity during peak periods (v/c ratios of .86-.1), and exceed capacity during the peak travel seasons (v/c ratios of 1.2-1.55). This will need to be addressed through two additional lanes and turning lanes on Archibald from south of Guasti to I-10. This will result in improved peak period mobility (v/c ratios of .8-.9). North of ONT, Archibald will carry a very high percentage of airport traffic.

Archibald south of the airport will receive additional airport related traffic from local development and reach v/c ratios of .67-.88, as will Jurupa (v/c ratios of .6-.8). However, Jurupa will be more congested at the intersection with Haven and Milliken.

The I-10/Archibald interchange will be subject to very high peak period congestion due to severe freeway capacity deficiencies (v/c ratio 1.7+). This will require on-, and off-ramp augmentation (two additional lanes) resulting in improved mobility.

Haven, east of ONT, will be congested due to increased airport and through traffic (v/c ratios of 1.2-.1.35). It will be more congested in the vicinity of the I-10 interchange during the AM and PM peaks (v/c ratios of 1.5-1.67). Congestion at the SR-60/Haven interchange will result from severe freeway capacity deficiency (v/c ratios of 1.5-1.61). To improve mobility, two lanes in each direction will be required on Haven from SR-60 to Foothill. Haven will carry low to moderate percentage of airport traffic.

Vineyard will be congested with additional airport and through traffic, since the currently vacant old terminal will be developed by 2030. North of I-10, Vineyard attracts more traffic and will approach and exceed capacity during peak periods. Two additional lanes will be needed from Airport to the I-10 interchange. Vineyard will carry a high percentage of airport traffic.

Milliken will need to be upgraded at the I-10 to accommodate additional air cargo and other regional high PCE (passenger-car-equivalent) truck traffic. Capacity improvements on Mission and Philadelphia will address congestion south of ONT.

Grove will exceed capacity during peak hours, and especially during the peak travel seasons (v/c ratios of 1.2-1.65). One additional lane will be needed in each direction including turning lanes (from I-10 to SR-60). The UCT grade separation will require widening on Grove to alleviate congestion (v/c ratios of 1.4-1.6). Additional capacity at Grove and I-10 will also be needed.

The major difficulty with ONT ground access will be freeway concession on I-15 (v/c ratios of 1.2-1.4), on the I-10 (v/c ratios 1.65-1.78) and on SR-60 (v/c ratios of 1.59-1.68). This will pose a ground access dilemma, as ONT will draw more passengers from much further away at 30 MAP. To improve mobility, two additional lanes will be needed on I-10 from Euclid to I-15 and on SR-60 from I-15 to Euclid.

Maglev will provide reliable and rapid regional access to ONT under the 2030 Preferred Aviation Plan.

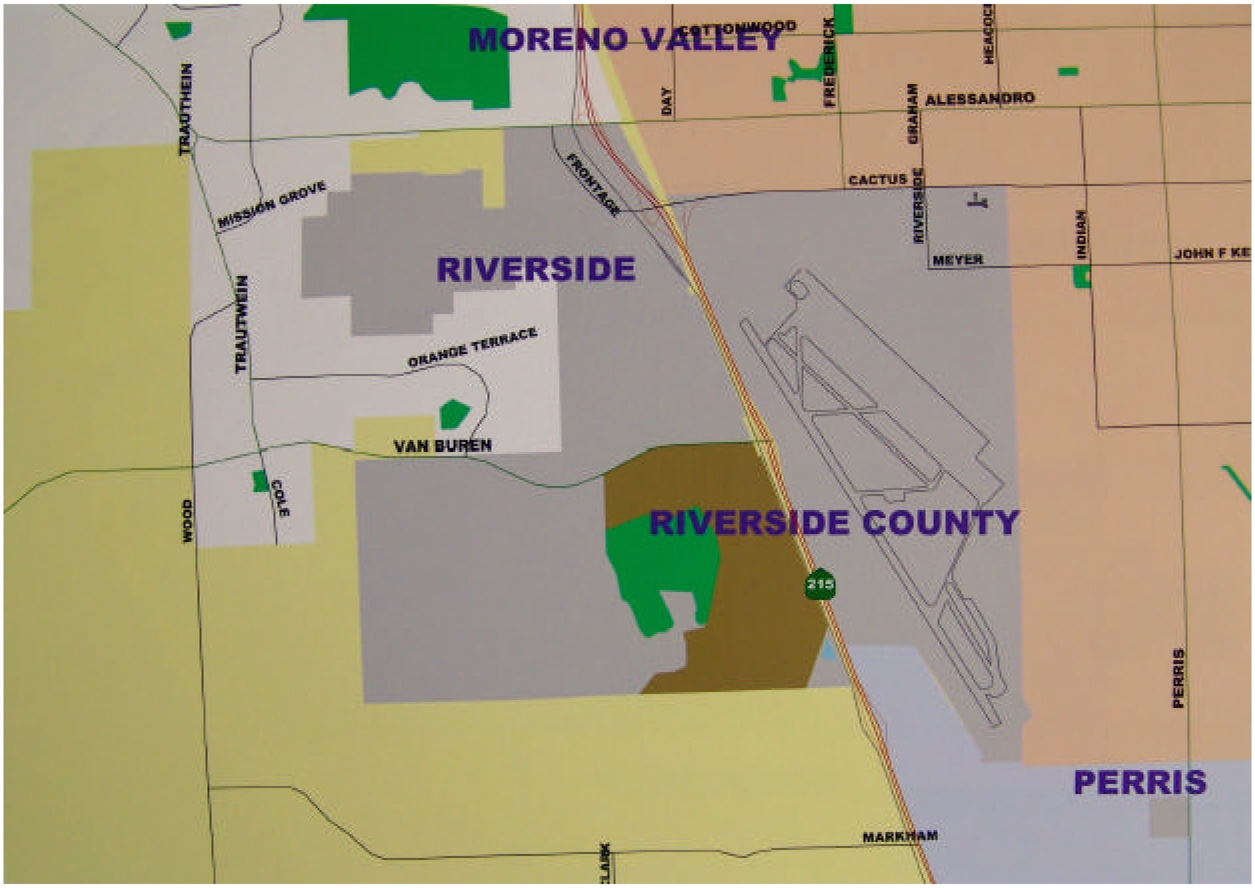
3.5. March AFB (MAR)

Under the 2030 Preferred Aviation Plan, March AFB is proposed to be a joint-use facility with a forecast of 8.0 MAP and 132,519 annual aircraft operations[10]. This is due to an increased demographic forecast for the Inland Empire, Maglev access, and the shifting of flights from constrained urban airports (i.e., LAX) to MAR through a “flight brokerage system”. As a result, the Preferred Aviation Plan forecast for MAR is substantially higher than the Constrained Alternative[11] forecast (1.03 MAP) without Maglev.

Under the Preferred Aviation Plan, MAR is forecast to serve 1.98 MAP (commuters), 3.95 MAP (short-haul), 1.27 MAP (medium- haul) and 0.80 MAP (long-haul). Due to its proximity to an international airport at ONT, March AFB will serve domestic passenger demand only.

MAR is well positioned to serve a substantial share of the regional air cargo. Under the Preferred Aviation Plan, it is projected to serve 1.12 million tons of air cargo annually, comprised of 416,000 tons of express, 499,000 tons of freight, 19,000 tons of mail, and 183,000 tons of e-commerce cargo. The low costs and ample real estate around MAR provide ideal conditions for efficient cargo warehousing and storage. The forecast includes 941,000 tons of domestic and 176,000 tons of international cargo. Domestic cargo may include some international cargo entering the U.S. through other airports.

[10] Commercial aircraft operations only.
[11] The Constrained Alternative limited MAR to commuter and short-haul service only.



Map of MAR and Environs

A new passenger terminal will need to be constructed in the vicinity of the I-215/Van Buren interchange, including an internal circulation system and parking. Air cargo terminal facilities will need to be built to accommodate substantial air cargo truck traffic, in the southeastern portion of the airfield. As an active U.S. Air Force base, priority will be given to military operations, particularly during deployment or national emergencies.

3.5.1. Existing Ground Access

March AFB is currently served by several major arterials, including Cactus, Alessandro, Perris and Frederick as well as the I-215 Freeway. Entrance to March AFB is located north of the base on Cactus. However, the future commercial passenger terminal will be on the west side of MAR at Van Buren.

Currently, the Van Buren/I-215 interchange serves as an access route to the air museum. It is generally uncongested throughout the day, but during the PM peak period the interchange becomes somewhat congested (v/c ratios of .74-.86). Further west, Van Buren connects to Troutwein, which is uncongested.

Average daily traffic on Cactus is below capacity. However, during the AM and PM peak periods, traffic increases, particularly west of Day and at the Cactus/Perris intersection.

Alessandro shows generally good traffic flow. However, during peak periods traffic increases at the I-215/Alessandro interchange as well as the I-215/Perris intersection (v/c ratios of .75-.85).

Perris, encompassing the base from the east, is relatively uncongested at the present time, as is Oleander.

Frederick is uncongested throughout the day. The intersection of Frederick and Cactus becomes more congested during the AM and PM peak periods (v/c rations of .88-.95)

During off-peak periods, I-215 traffic is well below capacity. However, during peak periods, traffic volumes approach capacity (v/c ratios of .72-.88). This congestion impacts the interchanges at Alessandro, Cactus, Van Buren and Kuder/Oleander.

3.5.2. Future Ground Access

In 2030, Van Buren is forecast to be severely congested due to traffic from an 8.0 MAP airport and growth in background traffic. Peak hour traffic volumes on the Van Buren/I-215 interchange will significantly exceed capacity (v/c ratios of 1.9-2+). This will require a significant upgrade of the Van Buren interchange with three-lane on- and off-ramps. Van Buren will also need to be widened to three lanes in each direction, plus an emergency lane, from I-215 to Troutwein, to achieve better traffic flow (v/c ratios of .75-.87). The Troutwein/Van Buren intersection will need to be upgraded with two additional turning lanes to operate below capacity (v/c ratios of .78-.9). Van Buren is projected to carry a very high percentage of airport traffic.

Cactus is forecast to significantly exceed capacity west of Perris (v/c ratios of 1.16-1.2) and east of the Cactus/I-215 interchange (v/c ratios of 1.25-1.38). To improve traffic flow, Cactus will need to be widened by one lane in each direction from I-215 to Perris. The Cactus/I-215 interchange will also need to be modified with additional turning lanes. Cactus will carry a low percentage of commercial airport traffic, but a very high percentage of military-related traffic.

MARCH AFB PROJECTS

215/Cactus IC

Alessandro shows peak hour traffic approaching capacity on several links in the vicinity of MAR (v/c ratios of .88-.97). West of I-215, Alessandro becomes even more congested (v/c ratios of 1.1-1.2). Alessandro will need to be widened by one lane in each direction from Troutwein to Perris to improve mobility (v/c ratios of .8-.85). The percentage of airport traffic on Alessandro will be low.

For most segments east of the air base, Perris will operate at capacity (v/c ratios of .97-1.15). However, with the added air cargo truck traffic, it will become congested, particularly during peak periods (v/c ratios of 1.2-1.35). To alleviate congestion, Perris will need to be widened by one lane in each direction from Oleander to Cactus (v/c ratios of .88-.95). Perris will carry a low to moderate percentage of airport traffic.

Frederick will serve primarily military and background traffic and operate below capacity. MAR airport traffic will comprise a very low percentage of total traffic on Frederick.

Oleander will carry a high percentage of air cargo truck traffic and experience severe peak period congestion (v/c ratios of 1.2-13.). Oleander will need to be upgraded with two additional lanes in each direction from I-215 to Perris. The Oleander/Perris intersection will also need to be improved with two turning lanes in each direction, resulting in improved traffic flows (v/c rations of .8-.9). Oleander will carry a low to moderate percentage of air passenger traffic.

MARCH AFB PROJECTS

Oleander

I-215 is projected to be more congested in the future (v/c ratios of 1.2-1.3), especially in the vicinity of SR- 60. This will require the upgrading of the SR-60/I-215 interchange with additional ramp capacity on the eastbound SR-60 to the southbound I-215 ramps, and to the northbound I-215 to the westbound SR-60 ramps. Airport traffic will comprise a moderate percentage of total traffic on I-215.

Traffic volumes on I-215 in the vicinity of Van Buren will exceed capacity (v/c ratios of 1.05-1.25). To improve accessibility to MAR, the Kuder/Oleander, Van Buren, Cactus and Alessandro interchanges will need to be upgraded.

3.6. Palm Springs International Airport (PSP)

In 2030, Palm Springs International Airport is forecast to reach 3.2 MAP, comprised of 3.01 MAP domestic and 0.19 MAP international. Domestic and international operations are projected to be 42,750 and 1,420, respectively. Passenger demand at PSP is highly seasonable with a peak during the winter months.

Map of PSP and Environs

Under the Preferred Aviation Plan, for domestic passengers PSP is projected to serve 0.48 MAP (commuters[12]), 1.66 MAP (short-haul), 0.51 MAP (medium-haul) and 0.36 MAP (long-haul). The projected forecast takes into account competition from ONT (30 MAP), which is served by Maglev. There is no Maglev connection to PSP under the 2030 Preferred Aviation Plan.

To accommodate additional passenger traffic, the internal circulation at PSP will need to be improved, including additional parking facilities. The ingress point to PSP from Tahquitz will need to be upgraded.

PSP is projected to be primarily a passenger airport with an air cargo forecast of 128,000 annual tons.

12 Includes passengers on regional jets.

3.6.1. Existing Ground Access

Tahquitz Canyon, Ramon, Indian Canyon, Palm Canyon and Gene Autry serve as the primary arterial access routes to PSP. From the north, PSP is accessible via the I-10/ Gene Autry, and the I-10/ Date Palm interchanges. At the present time, neither of the interchanges is congested, nor is I-10. However, speeds on I-10 drop significantly due to seasonal high wind conditions.

Existing arterial ground access is excellent with free flow conditions on Tahquitz Canyon, the main access route from downtown Palm Springs (v/c ratios of .3-.65). However, during the peak season, PM peak hour traffic on Palm Canyon severely impedes the flow at the Tahquitz/Palm Canyon and Indian Canyon intersections (peak hour v/c ratios of 1.0-1.2). The average speeds on Palm Canyon in the vicinity of the Tahquitz intersection are often low due to slow moving tourist traffic. During the PM peak, slow moving traffic on Palm Canyon also affects the Ramon intersection.

3.6.2. Future Ground Access

Peak hour congestion at the Palm Canyon/Tahquitz intersection (v/c ratios of 1.2-1.4) will be difficult to remedy due to high traffic volumes and slow speeds in downtown Palm Springs. This intersection carries a high percentage of airport traffic. In addition, major re-development is in the planning stages for the downtown area, which may further intensify traffic. Tahquitz/Palm Canyon and Tahquitz/Indian Canyon intersections will need to be upgraded to reduce peak hour, peak season congestion. Capacity improvements will help relieve congestion on Tahquitz/Palm Canyon and Tahquitz/Indian Canyon intersections (v/c ratios of .7-.9).

Ramon, an alternate route to PSP from the downtown area, will also be congested between Sunrise and El Cielo (v/c ratios of .8-1) and will need to be upgraded to a continuous, 4-lane major arterial. In addition, the Ramon/El Cielo intersection will need to be upgraded to accommodate air cargo truck traffic. Ramon carries a moderate percentage of airport traffic.

Farrell will be congested, especially between Ramon and Tahquitz Canyon, (v/c ratios of 1-1.1) during peak hours and will need to be widened by one lane in each direction (from Vista Chino to Ramon) to provide an alternate route to PSP. This will help reduce traffic at the Tahquitz/ Palm Canyon intersection. Farrell carries very high percentages of airport traffic at Tahquitz Canyon.

I-10 interchanges at Gene Autry and Date Palm will also need to be upgraded to facilitate improved access to PSP. Several improvements on Gene Autry will be needed, including widening (from I-10 to Silvia) and bridge construction at Gene Autry Trail and Whitewater River. These interchanges carry low percentages of airport traffic can help redirect airport traffic away from downtown Palm Springs.

3.7. Palmdale International Airport (PMD)

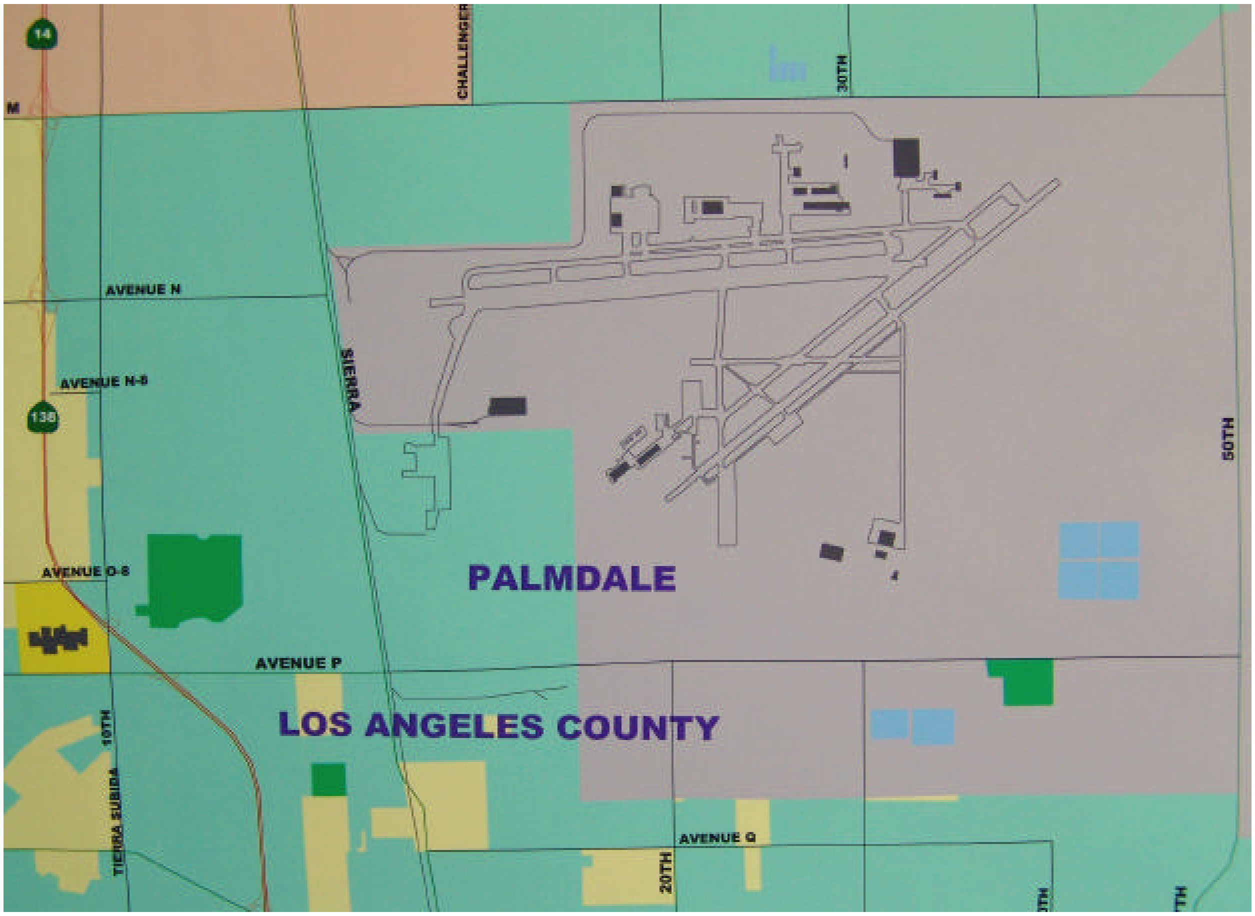
Under the 2030 Preferred Aviation Plan, Palmdale International Airport is forecast to reach 12.8 MAP. Annual domestic and international operations are projected at 180,318 and 10,438, respectively. This forecast was accomplished by the shifting of flights from LAX and other constrained urban airports to PMD under the “brokerage system”[13], the Maglev connection and the increased socio-economic forecast for North Los Angeles County. As a result, the Preferred Aviation Plan forecast for PMD (12.8 MAP) is much higher than the Constrained Alternative forecast (2.2 MAP) without Maglev. The Maglev connection is critical to PMD ground access, as SR-14 is forecast to suffer from recurrent congestion. In order to more efficiently decentralize air service in the region, the 2030 Preferred Aviation Plan assumed that SR-14 will provide reliable and uninterrupted access[14] to PMD.

Under the Preferred Aviation Plan, PMD will serve 2.07 MAP (commuters), 6.26 MAP (short-haul), 1.60 MAP (medium- haul), and 1.10 MAP (long-haul) domestic passengers. In addition, it will serve 1.76 MAP of medium and long-haul international passengers.

PMD is well positioned to serve a significant share of the 2030 regional air cargo market. Under the Preferred Aviation Plan, it is projected to serve 1.04 million tons of air cargo annually. Ample real estate in the high desert provides ideal conditions for cargo warehousing and storage. However, under the Preferred Aviation Plan, PMD is primarily designed to accommodate air passenger overflow from LAX and BUR, both of which are constrained to 78 and 10.7 MAP, respectively.

New airport facilities will need to be constructed south of the runway system. This will include an internal airport circulation system as well as airport and Maglev parking. New air cargo terminal facilities will also need to be constructed.

[13] An important feature of the Preferred Aviation Plan’s decentralization strategy.
[14] Reliable and uninterrupted access was expressed in the model as the “route reliability index”. This index was equalized with other airport ground access routes in the 2030 Preferred Aviation Plan.



Map of PMD and Environs

3.7.1. Existing Ground Access

Primary ground access to the existing PMD terminal consists of Avenue P, 20th Street, 25th Street, 30th Street, 50th Street, Sierra, Avenue M, and SR-14 in the study area.

Currently, there is no commercial traffic service at PMD and the airport terminal is vacant. Avenue P, a two-lane rural roadway, is uncongested from 50th Street to 30th Street. The Ave P/20th Street intersection operates at an excellent level of service. Closer to SR-14, traffic increases but remains well below capacity. The SR-14/Ave P interchange is uncongested.

Average daily traffic is well below capacity on 20th Street (v/c ratios of .01-.02). Traffic volumes on 50th Street are very light (v/c ratios of .38-.45), which also applies to Sierra and Avenue M (v/c ratios of .25-.45).

SR-14 is somewhat congested during the AM and PM peak south of Palmdale. Traffic on SR-14 is highly directional with an early southbound AM peak, whereas northbound traffic is heavier during the PM peak. Aside from commuter traffic, SR-14 also shows considerable truck traffic and is configured with truck climbing lanes due to steep grades (Palmdale is approximately 3000 ft. above sea level). During off peaks, traffic on SR-14 north of Palmdale is light.

3.7.2. Future Ground Access

Traffic volumes on Avenue P will significantly exceed capacity (v/c ratios of 1.77-2+) with particularly heavy congestion at SR-14 and the 20th Street intersection. Avenue P will carry a very high percentage of airport traffic. Air cargo truck traffic will also compound congestion at Avenue P and the SR-14/Ave P interchange. To alleviate congestion, Avenue P will need to be widened to four lanes in each direction with an emergency shoulder (from SR-14 to 50th Street). Avenue P intersections at 20th Street, 25th Street, 30th Street, 50th Street and Sierra will need to be significantly upgraded for passenger car and truck traffic with multiple turning lanes, resulting in improved peak period traffic flows (v/c ratios of .78-.85).

A high capacity intersection at Avenue P and 25th Street (three through lanes, dual turning lanes and shoulders) will improve access to PMD (v/c ratios of .72-.81).

The SR-14/Ave P interchange will need to be upgraded to alleviate congestion (v/c ratios of 1.8-2), with additional on-, and off-ramps capable of carrying increased volumes of truck traffic[15]. This would include on-ramps from westbound Ave P to northbound SR-14, and southbound off-ramps from SR-14 to Avenue P. These projects will improve mobility at this key ground access interchange (v/c ratios of .7-.9). The interchange is projected to carry a high percentage of airport traffic.

Sierra, skirting the airport on the west, is forecast to be highly congested (v/c ratios of 1-.1.2). To improve mobility, Sierra will need to be widened by one lane in each direction from Palmdale Bl. to Avenue M. Sierra will carry a low to moderate percentage of airport traffic.

Traffic on Avenue M which, encompasses the northern portion of the air base, is also forecast to be over capacity (v/c ratios of 1.15-1.35). This will require the widening of Avenue M by one lane in each direction, and intersection improvements at Sierra and 50th Street. Avenue M will carry a low percentage of airport traffic.

[15] This includes higher passenger-car-equivalent or PCE truck traffic.

Traffic on 50th Street will grow significantly due to rapid development in conjunction with traffic generated by a 12.8 MAP airport. It will need to be augmented with two additional lanes in each direction including emergency shoulders. Traffic on 50th Street will be comprised of a moderate percentage of airport traffic.

Widening of 30th Street from Avenue P to Palmdale, with two-lane turning lanes at Avenue P, will improve PMD access (v/c ratios of .65-.8). It is forecast to carry a moderate percentage of airport traffic.

3.8. Long Beach Airport (LGB)

In the 2030 Preferred Aviation Plan, Long Beach Airport is forecast to reach 3.8 MAP compared to 3.0 MAP for the Constrained Alternative. The 3.8 MAP forecast is consistent with the legally-enforceable 41 flights/day constraint at the airport.

Map of LGB and Environs

Under the 2030 Preferred Aviation Plan, LGB will serve 0.72 MAP (commuters), 0.76 MAP (short-haul), 1.10 MAP (medium- haul), and 1.22 MAP (long haul) domestic passengers.

To accommodate additional passenger traffic, the terminal facilities at LGB will need to be upgraded. LGB is forecast to be primarily a passenger airport, with an air cargo forecast of 136,942 annual tons.

3.8.1. Existing Ground Access

Ground access to LGB is primarily served by Lakewood Bl., Spring Street, Wardlow, Carson and the I-405 Freeway.

Lakewood, the direct access route to LGB, is generally below capacity during peak periods (v/c ratios of .7-.9). North of the I-10 interchange, Lakewood becomes more congested with peak hour traffic approaching capacity (.9-.95).

Spring Street, encompassing the airport from the south, is also congested during peak periods. At the I-405/Spring Street interchange, peak direction flows approach and sometimes exceed capacity.

Wardlow is a major arterial facing LGB and is more congested during peak periods. Carson, an east-west major arterial north of LGB, shows acceptable levels of service.

I- 405 suffers from severe congestion during the AM and PM peak periods (v/c ratios of 1.16-1.3). It is also often congested during off-peaks.

3.8.2. Future Ground Access

Lakewood will be congested due to a combination of growing airport and background traffic (v/c ratios of 1-1.3). Airport traffic will account for a high percentage of traffic on Lakewood. At the Lakewood/Wardlow intersection that percentage will be very high. To improve traffic flow, Lakewood needs to be widened by one lane in each direction from I-405 to Carson. The Lakewood/Wardlow intersection needs to be upgraded in view of increased airport traffic and through traffic. The upgrades to Lakewood will result improved mobility (v/c ratios of .65-.75). The 405/Lakewood interchange also needs to be upgraded to facilitate improved access to LGB.

Traffic on Spring Street is forecast to reach and exceed capacity (v/c ratios of .9-.1.2). To alleviate congestion, Spring Street needs to be widened to a 4-lane, major arterial configuration (from Orange Blvd. to Cherry), with an upgraded intersection at Lakewood. This will improve traffic flow to acceptable levels (v/c ratios of .6-.77). Spring Street carries low to moderate percentages of airport traffic.

Wardlow is projected to approach capacity (v/c ratios of .8-1) in the vicinity of LGB. To improve ground access to LGB, Wardlow needs to be widened by one lane in each direction from

Lakewood to Bellflower. Airport traffic will account for a moderate percentage of traffic on Wardlow.

Carson is forecast to generally operate below capacity (v/c ratios of .8-.9). It will carry a low percentage of airport traffic.

Future peak period congestion on I-405 will be severe (v/c ratios of 1.2-1.48). This will require numerous upgrades and capacity improvements, including additional HOV lanes. Airport traffic generated by LGB will comprise a low percentage of total traffic on I-405.

3.9. San Bernardino International Airport (SBI)

Under the 2030 Preferred Aviation Plan, San Bernardino International Airport is forecast to reach 8.7 MAP with 144,450 annual operations. This forecast was accomplished by the shifting of flights from LAX and other constrained urban airports to SBI under the "brokerage system"[16], a Maglev connection and an increased socio-economic forecast for the Inland Empire. As a result, the Preferred Aviation Plan forecast for SBI is higher than the Constrained Alternative forecast of 2.5 MAP without Maglev.

Under the Preferred Aviation Plan, SBI will serve 2.35 MAP (commuters), 4.82 MAP (short-haul), 1.13 MAP (medium- haul) and 0.44 MAP (long-haul) domestic passengers. Due to its proximity to ONT (30 MAP), SBI will not have international service.

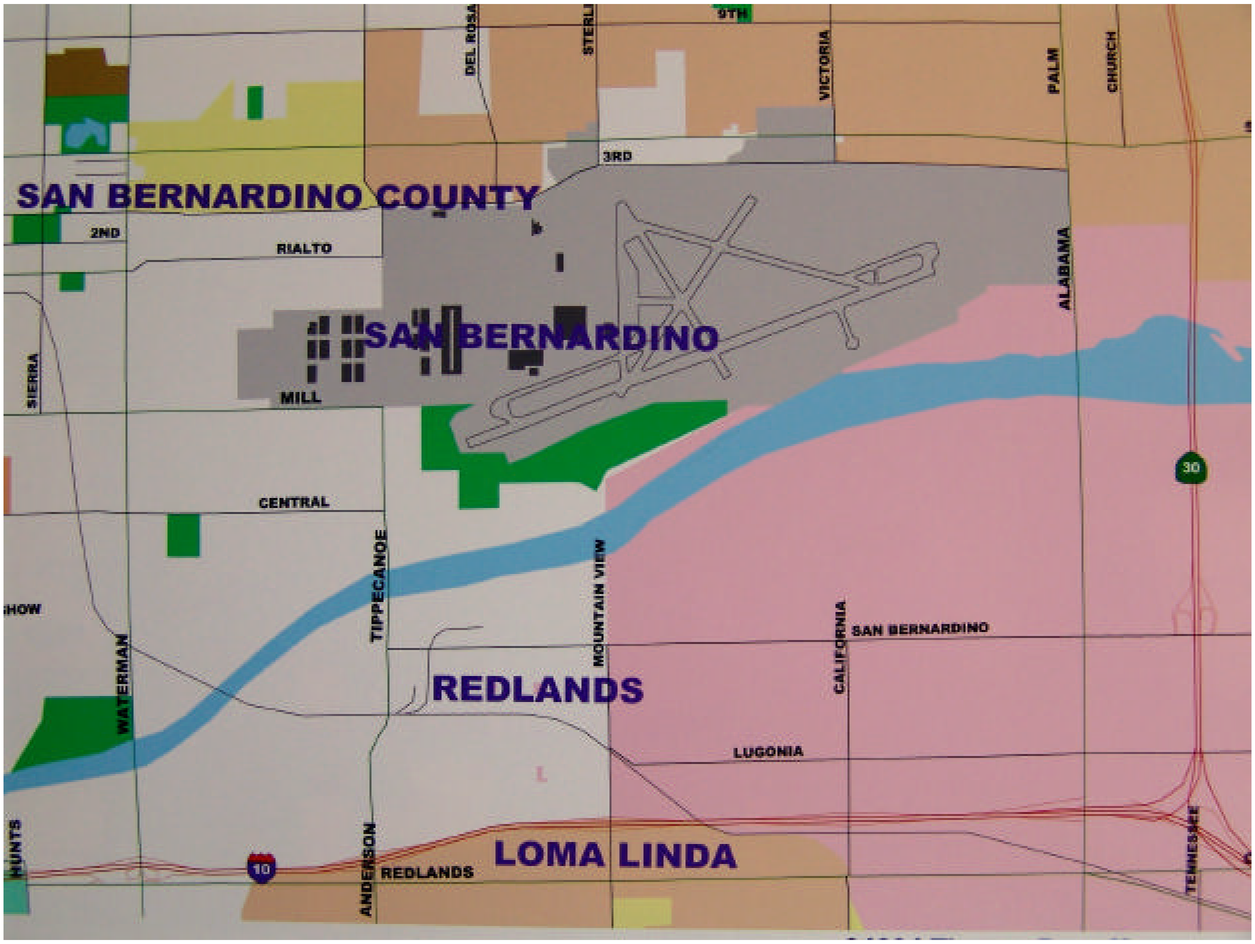
SBI is well positioned to serve a significant share of the 2030 regional air cargo market. Under the Preferred Aviation Plan, air cargo is diverted from urban airports to SBI and other outlying airports. SBI reaches a forecast of 1.09 million tons of air cargo annually. Under the Preferred Aviation Plan, SBI is designed to work in a synchronized fashion with ONT in serving air passengers and cargo.

New airport facilities will need to be constructed west of the runway system. This will include an internal airport circulation system as well as airport and Maglev parking. New air cargo terminal facilities will also be needed to accommodate substantial air cargo volumes.

3.9.1. Existing Ground Access

Primary ground access to SBI consists of Tippecanoe, Waterman, Mill, Rialto, and 3rd Street, in addition to I-10 to the south, I-215 to the west, and SR-30 to the east of the airport.

16 An important feature of the Preferred Aviation Plan's decentralization strategy.



Map of SBI and Environs

Tippecanoe, traversing the former air force base, is currently relatively uncongested with acceptable levels of service in the vicinity of SBI. This also holds true for most segments of Mill, which is a major divided arterial connecting SBI with I-215. Rialto, 3rd and 5th Streets are also uncongested. In the vicinity of I-10, traffic increases substantially on Tippecanoe, Waterman and Alabama (v/c ratios of .6-.92)

Waterman is surrounded by retail development that generates local traffic. During peak periods some of the intersections approach capacity; however, the average daily traffic flow is acceptable.

I-10 is recurrently congested with traffic approaching capacity during both the AM and PM peak periods. SR-30, to the east, suffers moderate peak period congestion. I-215 is outside of the study area, but it is estimated to operate under capacity.

3.9.2. Future Ground Access

The redistribution, rather than concentration, of airport traffic can improve SBI ground access on Tippecanoe, Waterman and the congested I-10. A strategic redistribution of traffic west to I-215 (via Mill and 3rd Street) and east to SR-30 will reduce ground access congestion. This will require an upgrade of 5th Street to a six lane major arterial configuration (with turning lanes), and improved capacity of intersections at 3rd Street, Palm, Waterman, and La Rosa. Improvements to 3rd Street will include two additional lanes in each direction from Waterman to Alabama/Palm, in addition to the construction of a six-lane diagonal connector road from 3rd Street to 5th Street in the vicinity of the SR-30/5th Street interchange.

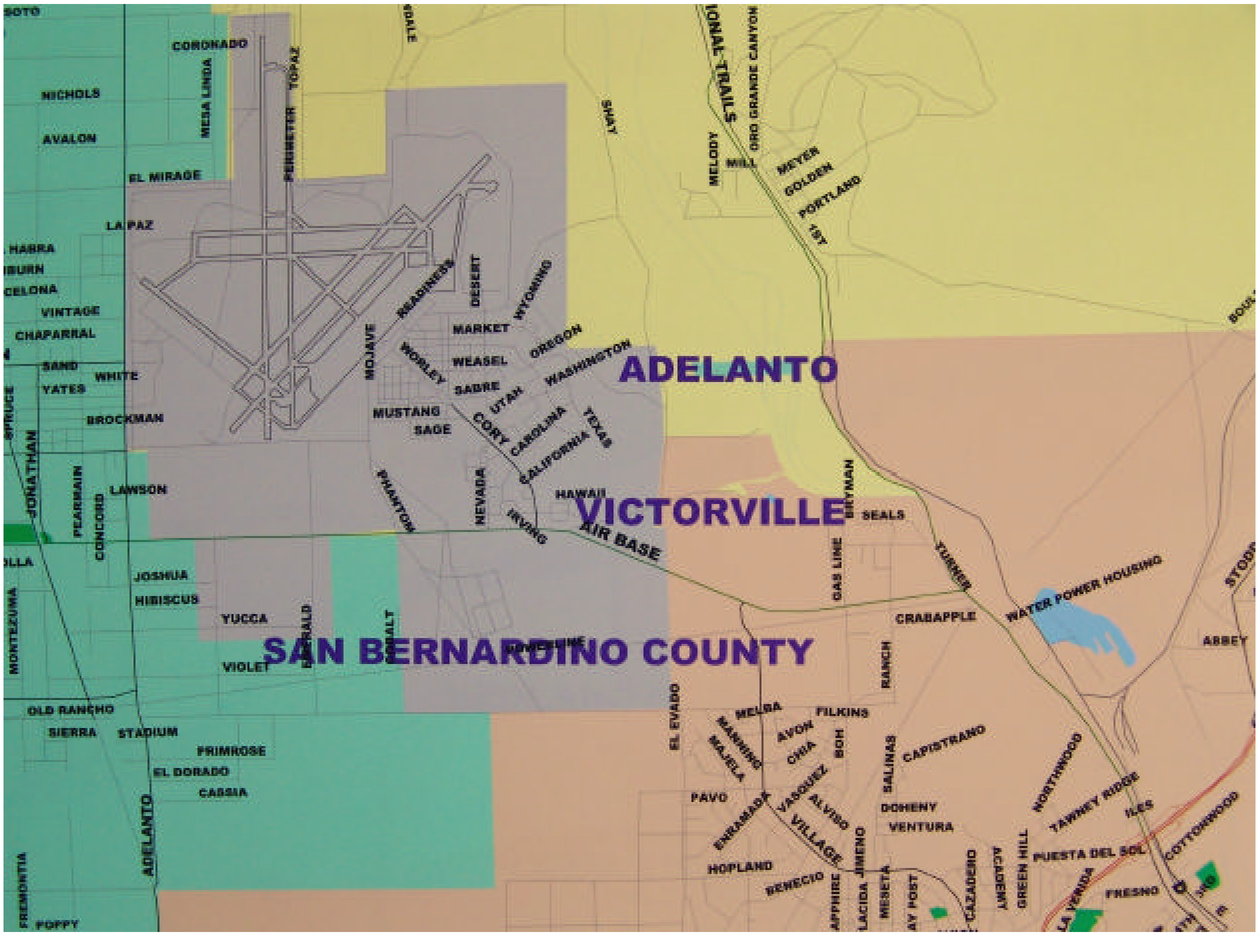
Tippecanoe is forecast to exceed capacity in the vicinity of SBI as well as at the Tippecanoe/I-10 interchange (v/c ratios of 1.2-1.35). This will cause traffic backups north and south of the Tippecanoe/I-10 interchange, affecting access to SBI. North of SBI, traffic on Tippecanoe will also exceed capacity at 3rd and 5th Streets (v/c ratios of .97-1.28). To alleviate congestion, Tippecanoe will need to be widened by one lane in each direction from 9th Street to Rialto and from Vanderbilt to the I-10 interchange. This will result in improved mobility (v/c ratios of .87-.9). Airport traffic will comprise a very high percentage of traffic on Tippecanoe.

Waterman will become significantly congested (v/c ratios of 1.2-1.47) due a combination of local retail access traffic, through and airport traffic. Peak period congestion will increase further in the vicinity of I-10 (v/c ratios of 1.5-1.7). The Waterman/I-10 interchange will also become more congested with peak period traffic backing up north and south of the interchange (v/c ratios of 1.68-1.81). To reduce congestion, Waterman will need to be widened by two lanes in each direction from 9th Street to Rialto and from Vanderbilt to I-10. The Waterman/I-10 interchange will need to be modified with additional ramp capacity for passenger and truck traffic.

To help distribute traffic, the I-215/Mill interchange will need to be upgraded with additional ramp capacity. Rialto may also play a strategic role in the redistribution of future airport traffic, depending on the future airport internal circulation design.

3.10. Southern California Logistics (SCL)

Southern California Logistics Airport is located at the site of the former George AFB and is projected to reach 4.0 MAP and 87,494 annual aircraft operations (commuter and air carrier) under the 2030 Preferred Aviation Plan. This exceeds the 2030 Constrained Alternative forecast of 0.8 MAP, due to the increased demographic forecast for Inland Empire and North Los Angeles County, Maglev access, and the shifting of flights from constrained urban airports to SCL through a "brokerage system".



Map of SCL and Environs

Under the Preferred Aviation Plan, SCL will serve 1.58 MAP (commuters), 2.20 MAP (short-haul), and 0.22 MAP (medium-haul) domestic passengers. At 4.0 MAP, the airport does not provide sufficient domestic feeder service for international flights, particularly with international service at ONT operating at 30 MAP.

Southern California Logistics is well positioned to serve a significant share of regional air cargo. Under the 2030 Preferred Aviation Plan, it will serve 504,000 tons of air cargo annually, comprised of 121,000 tons of express, 243,000 tons of freight, 6,000 tons of mail, and 134,000 of e-commerce cargo. Low costs and availability of real estate in the high desert provide ideal conditions for e-commerce warehousing and storage. The forecast includes 410,000 tons of domestic and 94,000 tons of international cargo. Domestic cargo may include some international cargo that entered the U.S. via other airports.

New airport and cargo terminals will need to be constructed with connector roads to Air Base and Kuder/Oleander. An internal circulation system, including parking facilities, will also be required.

3.10.1. Existing Ground Access

Major ground access facilities serving SCL include I-15, National Trails, Air Base and Adelanto. Currently, there is no commercial air carrier service at SCL. Other airport-generated trips have a very minor impact on ground access. The entrance to SCL from Air Base is a wide, uncongested multi-lane intersection.

Air Base, a major arterial, is currently uncongested with volumes far below its capacity. There is no congestion at the Air Base/National Trails intersection or at the junction of National Trails and I-15. However, I-15 becomes congested with speeds dropping to 30 mph on weekends due to traffic returning from Las Vegas. During long holidays, Las Vegas traffic causes more significant congestion on I-15 (v/c ratios of .8-1.1). This type of congestion is not reflected in modeling of average daily traffic but must be considered in ground access planning. At the present time, Air Base carries very low volumes of airport traffic.

National Trails provides the ground access connection to Barstow. Except for non-recurrent congestion (due to traffic accidents), National Trails is relatively uncongested. However, during peak hours National Trails becomes more congested, particularly between Air Base and I-15. Slower moving truck traffic reduces speeds on National Trails from I-15 to Barstow due to the two-lane configuration. Further to the north, National Trails becomes more congested within the City of Barstow.

There is a two-lane railroad underpass located north of SCL on National Trails. Future capacity improvements must address the railroad underpass which, given higher traffic volumes including truck traffic, will become a choke point.

3.10.2. Future Ground Access

The 2030 air cargo forecast for SCL is 504,000 tons, which will generate substantial truck traffic, in addition to background truck traffic. The Maglev station at SCL will also generate additional commuter traffic.

Air Base will serve as the primary access route to SCL and the Maglev station. Therefore, it will carry significant airport and Maglev-related traffic volumes. Total combined airport and background traffic on Airbase will exceed eastbound capacity (v/c ratios of 1.2 to 1.3) during the AM peak hour. During the PM peak hour, traffic will exceed westbound capacity (v/c ratios 1.2 to 1.3). To alleviate this congestion, Air Base will need to be widened by two additional lanes in each direction from US 395 to the National Trails. The Air Base/National Trails intersection will need to be improved in conjunction with the National Trails/Rancho intersection. Rancho will need to be extended from Adelanto to National Trails, resulting in improved traffic flow on Air Base (v/c ratios of .6-.85). Air Base is projected to carry a very high percentage of airport traffic.

I-15 will suffer from recurrent congestion particularly on weekends. Unlike urban freeways, I-15 will suffer the worst overcapacity (v/c of 1.1 to 1.2) during weekend peaks due to traffic returning from Las Vegas. On Sundays, southbound traffic will significantly exceed capacity (PM peak hour v/c ratios 1.15-1.22). Due to traffic generated by a 4.0 MAP airport as well as background traffic, the northbound and southbound ramp capacity at the I-15/National Trails interchange will need to be substantially upgraded. Airport traffic will comprise a low percentage of total traffic on I-15.

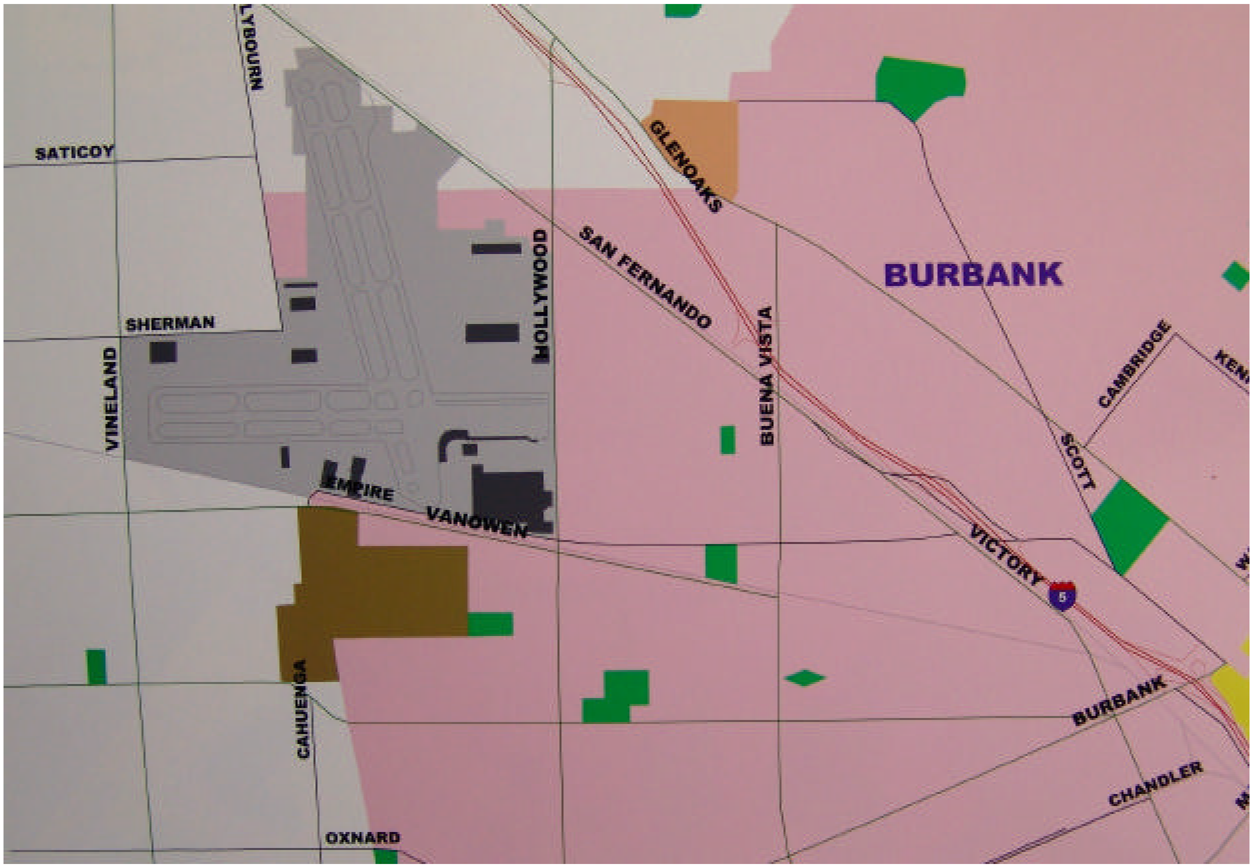
National Trails shows measurable increases in traffic, particularly air cargo truck traffic, compared to the current free-flow conditions. It is forecast to carry a high percentage of airport traffic, particularly between Air Base and the I-15 interchange. Capacity of National Trails will need to be improved by adding one lane in each direction from I-15 to Barstow, and two lanes in each direction on National Trails at I-15. This will result in lower improved mobility (v/c ratios of .6-.8).

The two-lane railroad underpass located 3.5 miles north of the National Trails/Air Base intersection will create a choke point. To restore traffic flow, the underpass will need to be modified to a four-lane configuration.

3.11. Bob Hope Airport (BUR)

Bob Hope Airport (formerly Burbank Airport or BUR) is forecast to reach 10.7 MAP under the assumptions of the 2030 Preferred Aviation Plan. This forecast was based on an assumption that LAX would be constrained to 78 MAP, and that urban airports would be moderately expanded, but without major new facilities such as new terminals or runways. The forecast for BUR was based on a capacity analysis that assumed the existing terminal plus three new remote aircraft parking positions. A modest decline in general aviation and air taxi operations was also assumed, which is consistent with past trends. Under the Preferred Aviation Plan, BUR is projected to serve 0.73 MAP (commuters[17]), 7.02 MAP (short-haul), 1.85 MAP (medium-haul) and 1.10 MAP (long haul) domestic passengers. The air cargo forecast for BUR is 87,100 annual tons in 2030.

[17] Includes passengers on regional jets.



Map of BUR and Environs

3.11.1. Existing Ground Access

The major arterial access routes to BUR include Hollywood, Vanowen, Buena Vista, and Alameda. BUR is also accessed by I-5 from the north and SR-134 to the south (outside the study area).

Hollywood Way is relatively uncongested during the AM and PM peak periods (v/c ratios of .55-.91). The worst intersections during the PM peak period are at Thornton and Alameda St. (v/c ratios of .83-.86). Hollywood at Winona intersections show the best performance, with excellent PM peak period characteristics (v/c ratios of .55-.56).

Generally, the PM peak period shows greater congestion on Hollywood than the AM peak period. During the AM peak period, the Winona/Hollywood intersection becomes more congested (v/c ratios of .65-.67). Traffic on Hollywood at Thornton is somewhat lower during the AM peak (v/c ratios of .77-.81)

Buena Vista shows an acceptable level of service during the AM peak period (v/c ratios of .63-.67). However, flow degrades during the PM peak at the Buena Vista and Victory (v/c ratios of .88-.89). The intersection at Empire remains relatively uncongested (v/c ratios of .79-.81). PM peak traffic on the Buena Vista/Empire intersection is well below capacity (v/c ratios of .6-.72).

Alameda at the SR-134 is relatively uncongested (v/c ratios of .63-.69). The Hollywood intersection approaches capacity during the PM peak (v/c ratios of .86-.88).

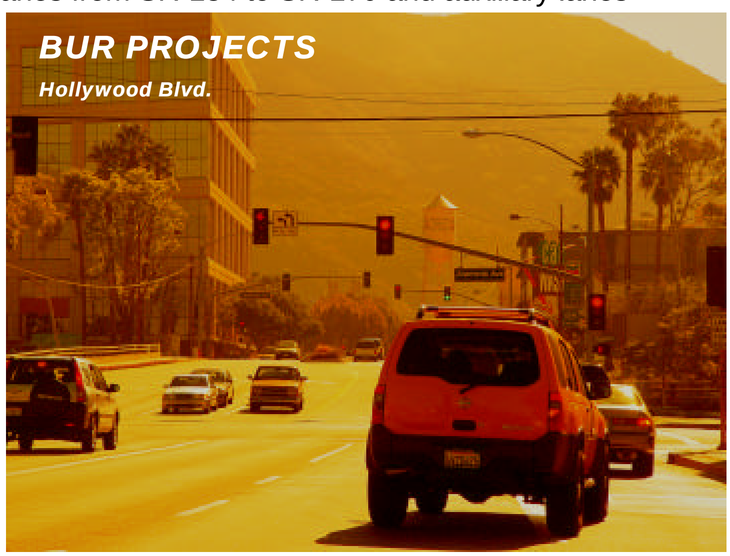
The Vanowen/Vineland intersection approaches capacity during the PM peak period (v/c ratios of .95-.99).

3.11.2. Future Ground Access

By 2030, the Preferred Aviation Plan generates high traffic volumes on Hollywood from San Fernando to SR-134 (v/c ratios .98-1.25). PM peak period congestion will force some traffic to divert to alternate routes. Hollywood will need to be upgraded with one lane in each direction (from San Fernando to Hollywood/Edison), resulting in improved mobility (v/c ratios of .78-.85).

However, the concentration of airport traffic on Hollywood will be problematic in 2030. Diffusing airport traffic easterly to I-5 at Empire and Buena Vista will help relieve congestion on Hollywood. This will require the construction of a modified interchange at Empire/I-5 (addition of north and southbound lanes) and Buena Vista/I-5. Hollywood will carry a very high percentage of airport traffic.

I-5 will also need to be upgraded with HOV lanes from SR-134 to SR-170 and auxiliary lanes from Burbank to Buena Vista, to reduce PM peak period congestion (v/c ratios of .88-.9). Airport traffic will comprise a low percentage of traffic on I-5.



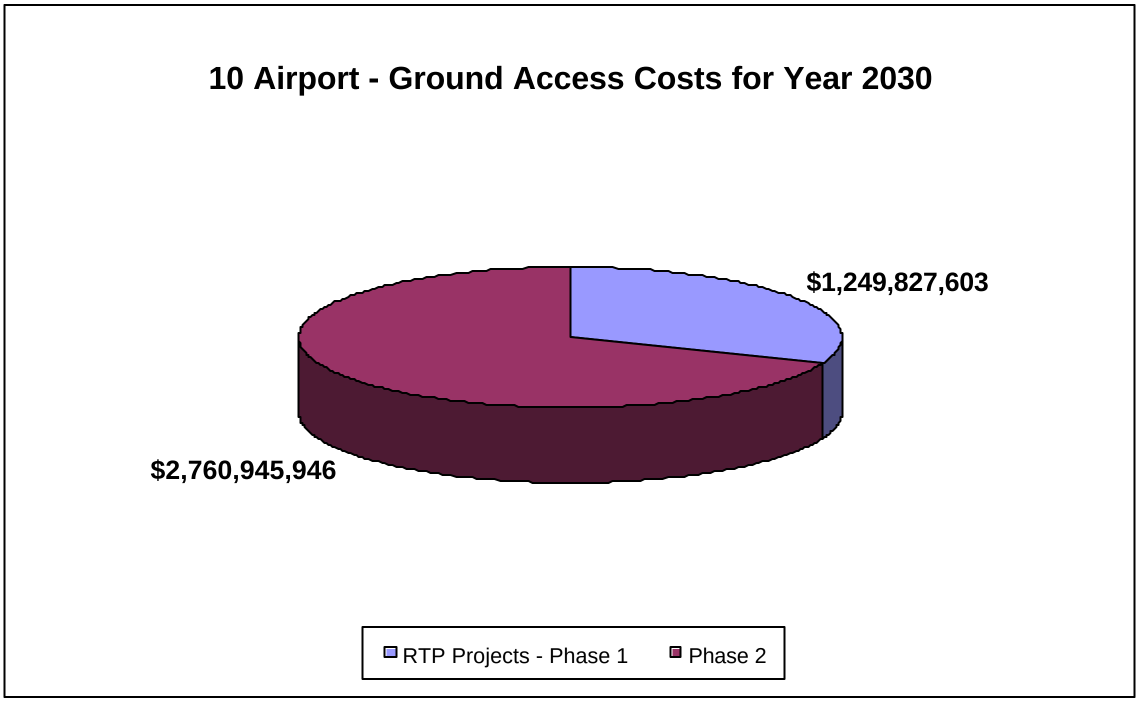
The Thornton/Hollywood intersection will be particularly affected by airport traffic (v/c ratios of 1.3-1.5) as well as background traffic. It will need to be improved with two additional turning lanes and increased turning lane storage capacity. This will reduce PM peak period congestion to more acceptable levels (v/c ratios of .78-.82).

The already complex access from eastbound SR-134 to northbound Hollywood will be compounded by severe peak period freeway congestion. The Alameda Whitnall Pass and Hollywood/Alameda intersections will need to be upgraded. However, the best strategy to restoring flow at the SR-134 junction will be to diffuse airport traffic east to the Empire and Buena Vista interchanges. SR-134 will carry a low percentage of airport traffic.

4. Cost Estimates

4.1. Phase of Work and RTP Status

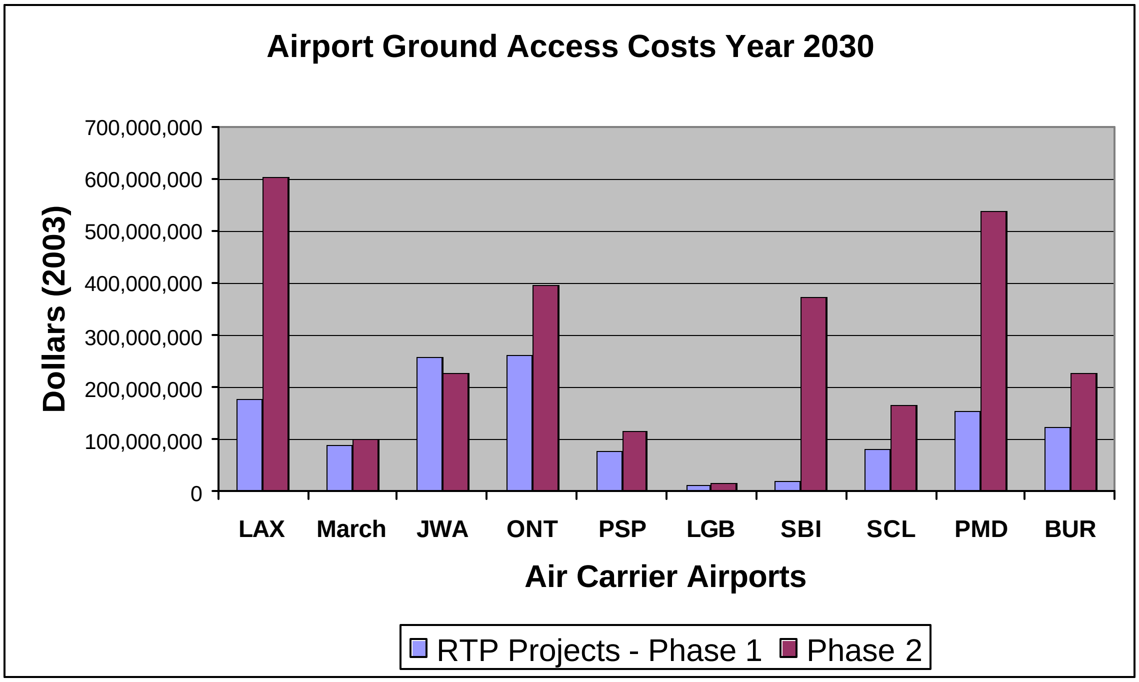
Based on the process described above, in Section 2, projects that have been identified as needed for the efficient access to the 10 air carrier commercial airports in the 2030 Preferred Aviation Plan. As a result of this effort, a total of $4.01 billion (in year 2002 dollars) in projects have been identified. Phase 1 project (those within the RTP) represent $1.250 billion, or about 31.2% of all needed airport ground access projects.



More than $1 billion in Phase 2 projects represent required parking structures and facilities at various airports. Although not all airports will need parking, many of those that are new or are greatly expending will. This set of improvements will most likely be self-financing through user fees (parking charges). Several airports, Like BUR will not need to expand parking on-site, and may have their needs handled by off-site, private entities. These costs are not included in this analysis.

On an individual airport basis, the totals of RTP (Phase1) and Phase 2 (Beyond the RTP) vary considerably. The projects represented in the combined lists of Phase 1 and Phase 2 are those required to provide or maintain adequate access. In addition, there are other improvements related to safety, security, convenience and other issues, which are not included.

In addition, Master Plans are being developed or refined for LAX, SBI and ONT, and a related Ground Access Study is underway for ONT. When these planning efforts are completed, revised costs and project lists will be available.



Estimated airport ground access cost totals are shown below for each airport and for each phase. These figures are the same as those represented in the chart immediately above. The totals are the same as those represented on the pie chart (previous page).

AIRPORT	Ground Access Cost	
	RTP – Phase1	Phase 2
LAX	$176,006,500	603,857,000
March	88,775,444	100,050,444
JWA	256,579,000	227,427,859
ONT	262,016,909	394,629,770
PSP	77,456,000	115,984,860
LGB	12,000,000	16,468,000
SBI	19,401,463	371,163,500
SCL	82,767,000	166,051,850
PMD	151,924,286	537,010,246
BUR	122,901,000	228,302,417
Phase Total	$1,249,827,603	$2,760,945,946
GRAND TOTAL		**$4,010,773,549**

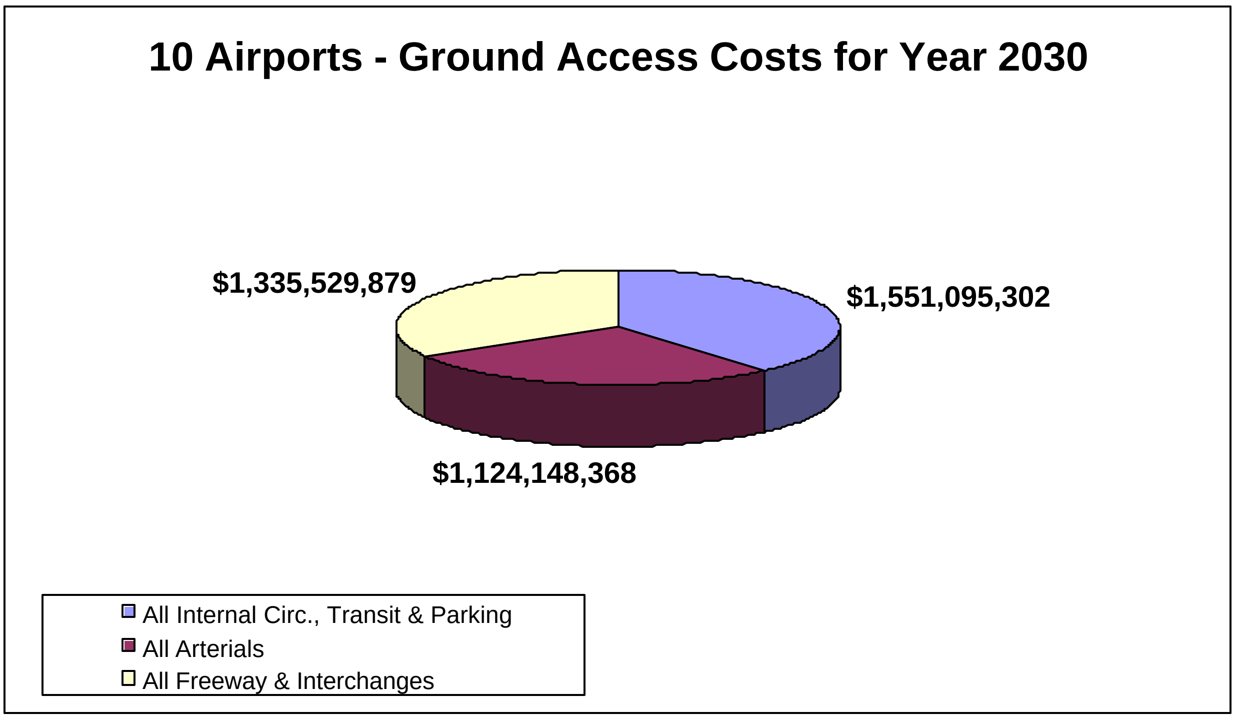
4.2. Project Type

Costs were also categorized by the type of ground access project required. As previously mentioned, these categories were established, as follows:

- Internal Circulation, Transit Facilities, and Parking
- Arterials
- Freeways and Interchanges

In analysis of all airports and both Phases (within the RTP and beyond), it was found that there was an almost even distribution between the three categories:

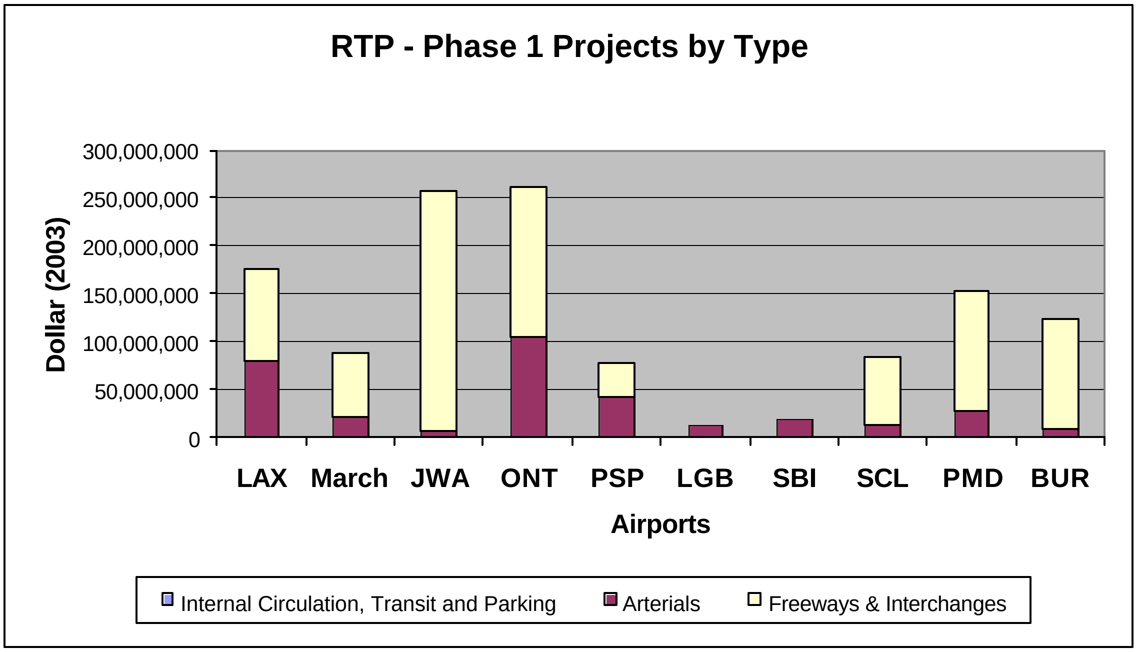
- 38.7% = Internal Circulation, Transit Facilities, and Parking
- 28.0% = Arterials
- 33.3% = Freeways and Interchanges



However, it was found that individual airports have their own needs among these categories. This was determined to be, in part, because of their location, capacity of existing facilities, growth levels anticipated, and related factors.

4.2.1. RTP (Phase 1) Projects

The following chart illustrates all projects contained within the RTP (Phase 1) by airport. Note that RTP projects related to airport ground access needs are relatively high for both John Wayne Airport (JWA) and Ontario International Airport (ONT). This is due to the cost of freeway, interchange and, to a lesser degree, arterial projects around these airports that serve both airport access and background traffic purposes. This same trend holds for other airports, as well.

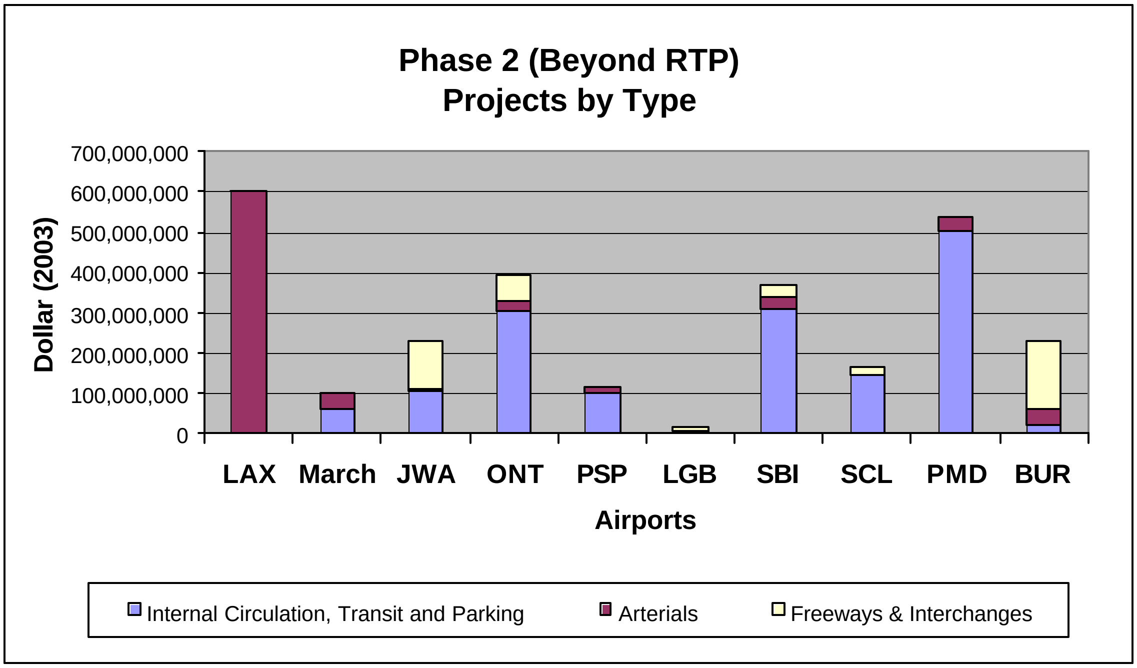


Note that in the chart (above) and the table (below) that none of the RTP (Phase 1) projects are those categorized as "Internal Circulation, Transit and Parking." This is not to say that these projects are not a priority. However, it should be noted that these projects, including more than $1 billion in parking costs and additional costs, are not now included in the RTP within this category. Maglev system and station costs are in the RTP and listed elsewhere in the document.

AIRPORT	RTP-Phase 1 Ground Access Cost		
	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
LAX	0	$78,933,500	$97,073,000
March	0	20,796,000	67,979,444
JWA	0	6,951,000	249,628,000
ONT	0	104,516,000	157,500,909
PSP	0	43,016,000	34,440,000
LGB	0	12,000,000	0
SBI	0	19,401,463	0
SCL	0	11,855,000	70,912,000
PMD	0	28,000,000	123,924,286
BUR	0	7,717,000	115,184,000
Phase Total	0	$333,185,963	$916,641,640
GRAND TOTAL			$1,249,827,603

4.2.2. Phase 2 Projects

The following chart illustrates all Phase 2 projects by airport. However, as with RTP-Phase 1 projects, it was found that individual airports have their own needs among the three categories. Again, this was determined to be, in part, because of their location, capacity of existing facilities, grow levels anticipated, and related factors. The following chart illustrates all projects contained within the Phase 2 (Beyond the RTP) by airport.



Note that Phase 2 (Beyond the RTP) projects in the chart (above) and the table (below) related to airport ground access needs are relatively high for LAX, particular in the category of arterial projects. When the Master Plan efforts at this and other airports (ONT and SBI) are completed, it is expected that these figures and projects mix will change. In some cases, the changes will be significant. Most of the airports also have a fairly large component of costs attributed to parking. The future parking costs can be offset by parking fees, if the airport authorities so desire. The total for this new parking could be more than $1 billion, as previously mentioned.

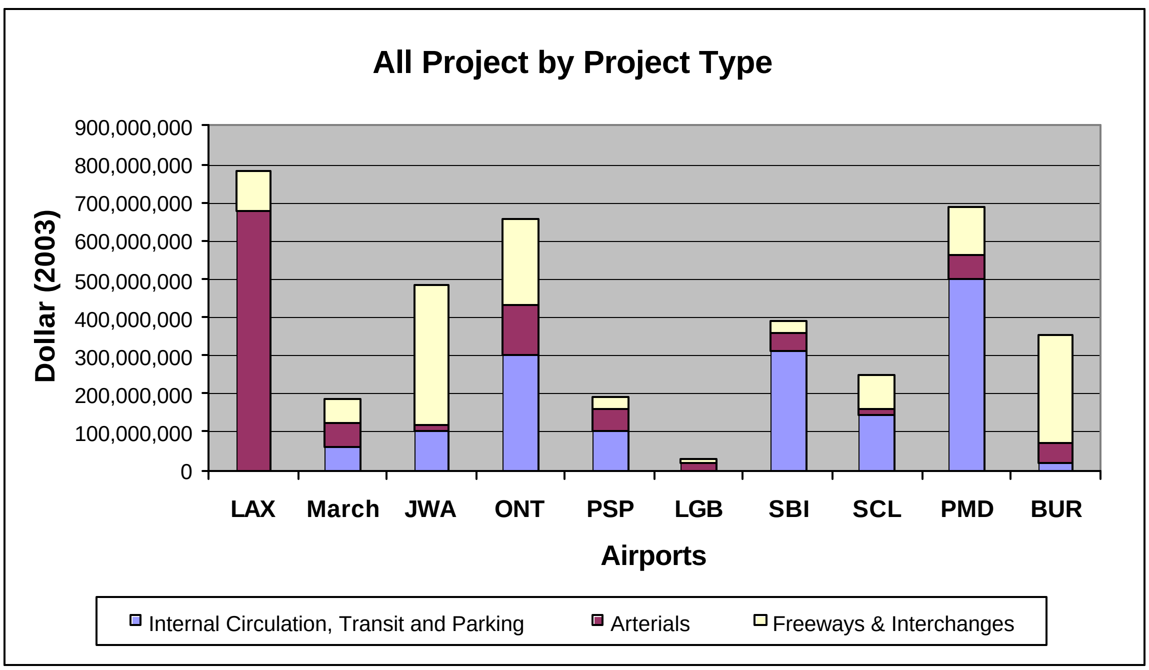
AIRPORT	Phase 2 Ground Access Cost		
	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
LAX	0	$599,857,000	$4,000,000
March	$62,400,000	37,650,444	0
JWA	105,462,628	5,013,500	116,951,731
ONT	303,569,928	23,340,000	67,719,842
PSP	100,644,600	15,340,260	0
LGB	0	4,967,000	11,501,000
SBI	310,504,500	27,659,000	33,000,000
SCL	145,955,850	0	20,096,000

AIRPORT	Phase 2 Ground Access Cost		
	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchang es
PMD	502,578,046	34,432,200	0
BUR	19,979,750	42,703,000	165,619,667
Phase Total	$1,551,095,302	$790,962,404	$418,888,240
GRAND TOTAL			$2,760,945,946

Referring to the table (above), note that there are significant costs for most of the airports, especially those that are to transition from military uses or under-utilization to air carrier status.

4.2.3. All Projects (Phases 1 and 2)

The following chart illustrates all projects by airport. However, it was found that individual airports have their own needs among the three categories. Again, this was determined to be, in part, because of their location, capacity of existing facilities, grow levels anticipated, and related factors. The following chart illustrates all projects by airport.



Note that internal circulation costs (including parking facilities) are substantial. If these airports are to grow rapidly, than their parking fees and other user fees may have to be used to back revenue bonds or other financial instruments, in order to build the facilities when needed. If, on the other hand, these airports grow gradually, the required facilities and access projects can be fulfilled from user fees on hand. Regardless of the financial means of accomplishing these tasks, the result of this analysis is that the needs are many and the costs are high.

Noting the following chart (above) and table (below), this brings together all projects from Phase 1and Phase 2. Again, it is expected that when Master Plans are completed for LAX, ONT and SBI, the costs will change, and may increase substantially.

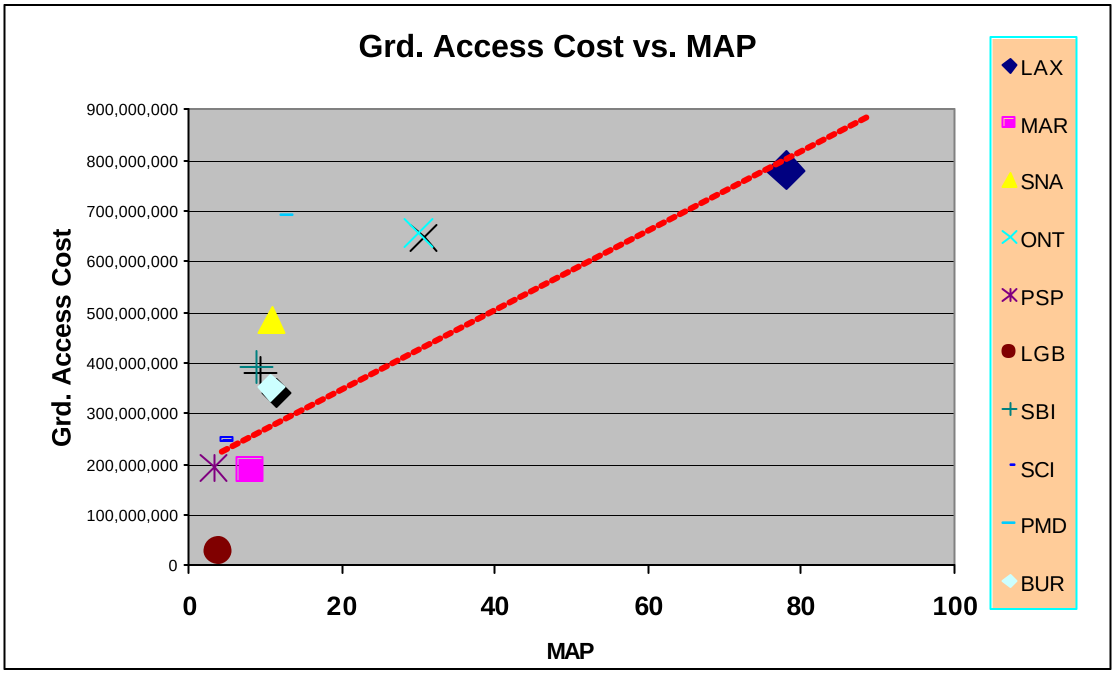
AIRPORT	TOTAL (Phases 1 and 2) Ground Access Cost		
	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
LAX	0	$678,790,500	$101,073,000
March	$62,400,000	58,446,444	67,979,444
JWA	105,462,628	11,964,500	366,579,731
ONT	303,569,928	127,856,000	225,220,752
PSP	100,644,600	58,356,260	34,440,000
LGB	0	16,967,000	11,501,000
SBI	310,504,500	47,060,463	33,000,000
SCL	145,955,850	11,855,000	91,008,000
PMD	502,578,046	62,432,200	123,924,286
BUR	19,979,750	50,420,000	280,803,667
Phase Total	$1,551,095,302	$1,124,148,368	$1,335,529,879
GRAND TOTAL			**$4,010,773,549**

What does this data indicate about the relative ground access costs facing these airports versus the number of passengers or tons of cargo that are forecast for them? The relationship between forecast demand and ground access costs varies from airport to airport. This is because some airports are in more congested areas and are more impacted by background traffic from surrounding development, and some airports that are forecast to handle substantial future demand have few existing facilities (and thus, their needs are greater).

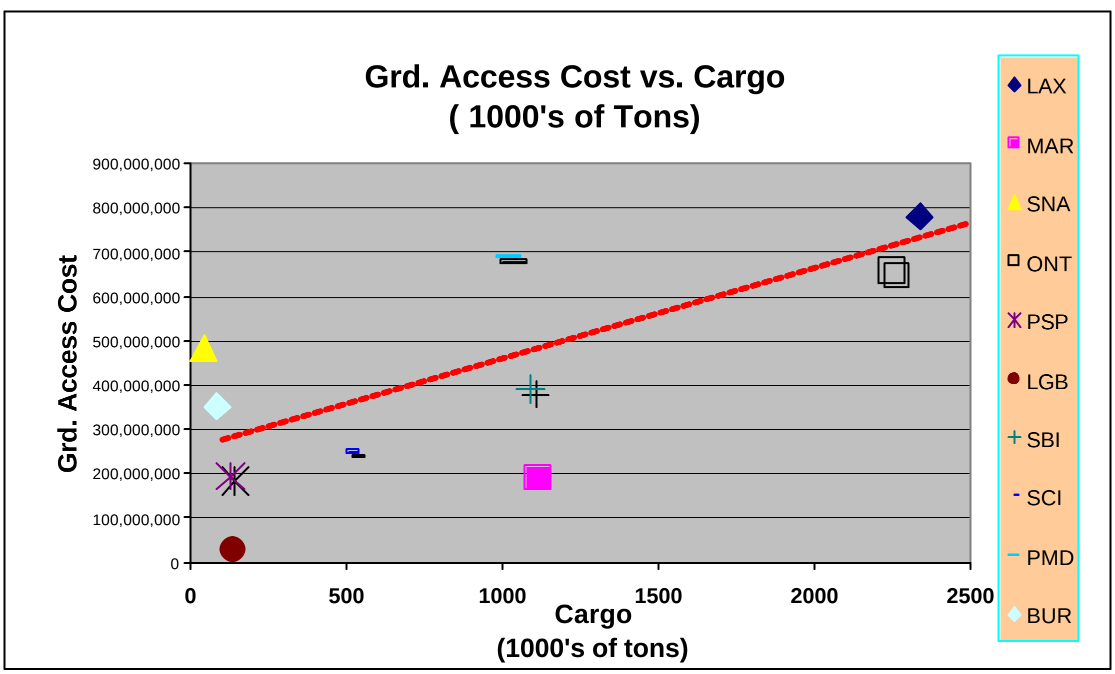
However, taken as a single set of data, there is a relationship between the airport ground access costs and the number of passengers and amount of cargo forecast for the horizon year (2030). This is note by the dashed line and individual airport data points of the following charts (below).

4.3. Cost Effectiveness and Plan Performance

The following charts illustrate the relationship between estimated total ground access costs and MAP, and estimated costs and thousands of tons of air cargo.



As in the passengers-versus-cost relationship, taken as a single set of data, there is a relationship between the airport ground access costs and the tons of cargo forecast for the horizon year (2030). This is noted by the dashed line and individual airport data points on the following chart (below).



As a general relationship, in order to service 10 MAP, it might be expected to cost approximately $300 million in just ground access costs. In order to service 1million tons of cargo at an airport, it might be expected to cost approximately $400 million. The figures for individual airports depend on many factors including existing levels of congestion.

5. Conclusion, Potential Future Steps

5.1. Ground Access Projects

A. The most fundamental conclusion of the study is that the ground access needs for the suburban (outlying) airports are a function of the limited potential for future expansion of LAX and other urban airports beyond their current capacities. Furthermore, that Maglev will play a crucial role in the development and growth of outlying airports, as local roadway projects are in addition to Maglev implementation. Both Maglev and the improvements are necessary to implement the Aviation Plan's decentralization strategy and to help move passengers and cargo from urban population and employment centers to suburban airports with available capacity.

B. Maglev is a key ground access component of the Preferred Aviation Plan and all projects are in addition to Maglev. Airports served by Maglev access will require additional projects for station access, internal circulation and parking. While on a large scale, Maglev will relieve freeway travel, it is not designed to alleviate arterial congestion in the immediate vicinity of airports. Consequently, the improvement projects focus on arterials and interchanges in the ten study areas rather than on system-wide freeway capacity enhancements.

C. As air services are decentralized, so is ground access, resulting in greater overlap of demand for capacity of shared roadways. The overlapping of airport traffic from several interactive airports requires an integrated tool, such as RADAM 9.11, that captures the traffic effects of all airports and Maglev simultaneously. As a result, many of the ground access projects for the Preferred Aviation Plan will benefit more than one airport.

D. The modeling of the Preferred Aviation Plan showed that there is a disproportionate distribution of currently funded projects among the ten airports. This is due to the fact that the Preferred Aviation Plan decentralizes air service to suburban airports through Maglev, "flight brokerage", increased demographic forecasts (for North Los Angeles County and Inland Empire) and a variety of other input assumptions designed to accelerate growth at suburban airports. As a result, RADAM modeling of the 2030 Preferred Aviation Plan generated higher forecasts[18] for suburban airports compared to the non-maglev Constrained Alternative. These forecasts required additional projects, which have not been identified in previous studies using lower airport forecasts. In addition, most previous studies focused on individual airports rather than on cumulative effects of ten airports on shared infrastructure. Most individual airport studies, such as master plans, typically do not address off-airport ground access improvement needs, or do not go very far off the airport.

E. Airport ground access is very dynamic and sensitive to flight portfolios and flight schedules of similar size airports. Predominantly commuter and short haul airports serve a higher percentage of local residents, who live closer to airports and use alternate routes to avoid congestion. This is in contrast to airports with a greater share of non-resident passengers flying to medium and long haul destinations. The origins and destinations of such passengers have a greater regional distribution and use more direct routes for airport access.

[18] PMD (12.799 MAP), SBI (8.736 MAP), SCL (4.002 MAP), ONT (30.023 MAP), and MAR (7.980 MAP).

F. Maglev will have limited impact on truck traffic and some of the improvement projects are designed to also mitigate truck-related impacts.

G. Airports as land uses do not typically generate greater surrounding traffic volumes than other types of developments. In a sensitivity test of LAX, the modeling showed that while the airport is often viewed as the culprit for surrounding traffic congestion, alternate land uses such as shopping centers would generate more traffic per acre. The primary reasons for giving priority to airport ground access projects are to maintain and enhance the efficiency of the entire regional aviation system, which is vital to the regional economy. It should also be noted that airport ground access could be overwhelmed by traffic generated by catalytic development that locates around airports.

H. Even the most fastidious modeling cannot anticipate all development that will occur in airport study areas and beyond. Ground access should be updated continually as new information becomes available.

I. From an economic perspective, the cumulative costs of ground access improvements for the ten airports must be compared with tangible gains in stimulating local and regional growth and establishing multiple gateways to national and global economies. A lack of adequate investment in future airport ground access improvements will hinder the region's ability to utilize available capacity at suburban airports, which would have negative impacts on the regional economy.

5.2. Cost Estimates

A. Approximately $4.01 billion in airport ground access improvements will be required to support the Preferred Aviation Plan and its 10 commercial air carrier airports. These improvement projects consist of internal circulation roads, transit facilitates, parking facilities, nearby arterial streets, interchanges, and freeway lanes. The mix of projects and costs varies significantly on an airport-by-airport basis.

B. In terms of cost estimates for airport ground access, approximately 31 percent of the required improvement projects are represented in the Regional Transportation Plan (RTP). The remainder of the projects should be viewed as work that remains to be done and/or can be self-financed. The biggest example of self-financed projects may be more than $1 billion in needed parking facilities. Maglev costs to connect the airports are included elsewhere in the RTP.

C. In analysis of all airports and both Phases (within the RTP and beyond), it was found that there was an almost even distribution between the three categories:

- 38.7% = Internal Circulation, Transit Facilities, and Parking
- 28.0% = Arterials
- 33.3% = Freeways and Interchanges

D. Master Plan efforts and Ground Access Studies are underway at LAX, ONT and SBI. When these studies and plans are completed, the estimates and means of financing these improvements are expected to change significantly. These studies and plans are also expected to outline funding options for the required improvements.

E. Funding for the improvements that are “within the airport fence” could be considered for passenger facility charges (PFC) financing. Some select improvements may also be eligible for FAA grants, although this may be much more limited. Up to this date, most of the improvement projects of the type contained with this document and the RTP are financed with dedicated surface transportation funding programs. These programs include, but are not limited to, Federal highway and transit grants and allocations, State transportation programs, sales tax proceeds dedicated to transportation improvements (on a county-by-county basis), and local transportation funding.

F. Discretionary funding from the State is likely to be very limited during the next 5 to 10 years. Congress is currently considering a new multi-year bill for the transit and highway funding programs. The final bill may look similar to the existing Federal legislation.

G. New and additional financing for the airport ground access improvements may need to be seriously examined as airports grow and new air carrier airports are brought on line. Meetings between airport authorities, county transportation commissions, Caltrans, and SCAG should be established in order to consider the challenges of the future ground access funding issues. As proposals are developed, other stakeholders could be included in the discussion, including air carriers, affected cities and counties, business and development interests in the vicinity of the airports, economic development agencies, and others.

Attachment A – Airport Ground Access Projects

LAX S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
LAX-1	Widen Sepulveda (from Manchester to El Segundo) to 5 lanes in each direction except for the Sepulveda Tunnel.	2.25*2	0.2	11,366,000	127,867,500	Similar Project, RTIP Project ID # LA0C8080 (Assumed an addition of 1 lane in each direction)	-	Unconstrained		
LAX-2	Reconfigure Sepulveda southbound to Imperial westbound off-ramps to 3 lanes plus an emergency lane.	2	1	10,202,000	20,404,000	Similar Project, RTIP Project ID # 17850	-	Unconstrained		
LAX-3	Widen Imperial (from Del Mar to I- 405 IC) from 3 to 4 lanes in each direction.	4.5*2	0.2	11,366,000	255,735,000	Similar Project, RTIP Local Project ID # LA0C8080	-	Unconstrained		
LAX-4	Construct I- 105 westbound to Sepulveda northbound off-ramps to 3 lanes plus an emergency lane configuration.	1	1	10,202,000	10,202,000	Similar Project, State RTIP Project ID #17850 (from 1 to 2 lanes)	-	Unconstrained the exact description but both the Baseline projects: 17850 and LA974313 are similar		
LAX-5	*Deleted*				0		-			
LAX-6	Reconfigure Pershing/Imperial Intersection with 2 turning lanes (from westbound Imperial to northbound Pershing, and from southbound Pershing to eastbound Imperial).	Tunring lanes and others	1	673,000	2,019,000	Similar Project, RTIP Project ID # LA0B7223	-	Unconstrained		
LAX-7	Deleted				0		-			
LAX-8	Widen Century Bl. (from CTA to the Century/I- 405 IC) to 5 lanes in each direction with turning lanes. Add two additional turning lanes to intersections of Century with Aviation and Airport.	2.75*4	0.2	11,366,000	312,565,000	Similar Project, RTIP Local Project ID # LA0C8080	-	Unconstrained		
LAX-9	Add 2 additional turning lanes to the Century/Sepulveda intersection (westbound Century to northbound Sepulveda).	2 no.	1 no.	400,000	800,000	Similar Project, RTIP Project ID # LA0C8003	-	Unconstrained		
LAX-10	Widen Aviation (from Arbor Vitae to Century) to 4 lanes in each direction. Widen Aviation from Century to Manhattan Beach Bl. to 3 lanes in each direction.				13,984,000	Same Project, RTIP Project ID # LA000373 (Assumed addition of 1 lane in each dir. From Arbor Vitae to MBB)	-	Baseline		
LAX-11	Upgrade Florence/I-405 IC. Add 2 lanes to each on-, and off-ramp.	4 lanes total	2 lanes tot	1,000,000	2,000,000	Similar Project, RTIP State Project ID # LA0D31	-	Unconstrained		
LAX-12	Widen Arbor Vitae (from I- 405 to Sepulveda) to 4 lanes in each direction and 2 left-turn lanes at Aviation and Airport intersections.	1.5*4	2	2,000,000	6,000,000	Similar Project, RTIP Local Project ID # LA000170	-	Baseline		
LAX-13	Upgrade La Tijera/Sepulveda IS. Add 1 additional turning lane from southbound La Tijera to southbound Sepulveda and from northbound Sepulveda to northbound La Tijera.				4,334,000	Same Project, RTIP Local Project ID # LA0C8056	-	Unconstrained		

LAX S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
LAX-14	Reconstruct I- 405 southbound off-ramp to La Cienega southbound to a major arterial 4-lane standard.	4 lanes total	2 lanes tot	1,000,000	2,000,000	Similar Project, RTIP State Project ID # LA0D31	-	Unconstrained		
LAX-15	Widen La Cienega from Arbor Vitae to Century Bl. to 3 lanes in each direction.	0.5	0.15	400,000	1,333,333	Similar Project, RTIP Project ID # LA0C8003 (Assumed 1 lane in each direction.)	-	Unconstrained		
LAX-16	In Inglewood construct south half of IC on Arbor Vitae.				52,127,000	Same Project, RTIP State Project ID # 49160	-	Baseline		
LAX-17	Sepulveda Blvd. From Centinela Ave. to Lincoln Blvd. - Widen Sepulveda Blvd. Between Lincoln and Centinela to Provide Bus/Carpool Prioroity Lanes.	2			2,662,000	Same Project, RTIP Project ID # LA996390	-	Baseline		
LAX-18	Add Northbound HOV Lane (from 0 to 1 lnae) Over Sepulveda Pass from I-10 US-101. (Southbound HOV from US-101 to Waterford Opened in Feb., 2002; Southbound HOV from Waterford to I-10 is in the BaselineProject ID# LA195900).				19,260,500	Similar Project, RTIP State Project ID # LA195900 Assumed half of the total cost.	-	Baseline		
LAX-19	Near Marina Del Rey from Hughes Terrace to La Tijera Blvd., Widne from 7 to 8 lanes, Add left Turn Lane, Modify Signals. (2001 CFP 8104).				4,752,000	Same Project, RTIP State Project ID # 16602	-	Baseline		
LAX-20	Near Marina Del Rey from Hughes Terrace to Fiji Way - Virous Widen Up to 4-Lane in Each Direction, Various Intersection Improvements - Widen from 6 to 8 Lanes. 2001 CFP 8105.				6,153,000	Same Project, RTIP State Project ID # 16601	-	Baseline		
LAX-21	Near Marina Del Rey on Lincoln Blvd. from Jefferson Blvd. To Fiji Way- Widen from 3 to 4 Through Lanes in Each Direction, Plus a 5th Lane in Each Direction for Ramp Connect. 2001 CFP 8106.	0.6			7,458,000	Same Project , RTIP State Project ID # 16607	-	Baseline		
LAX-22	Near Marina Del Rey at Culver Blvd. - Overcrossing Demolish Existing Overcrossing & Replace with New 6-Lane Overcrossing with Longer Span - Widen from 4 to 6 Lanes.	-			5,935,000	Same Project , RTIP State Project ID # 16605	-	Baseline		
LAX-23	Near Hawthorne and Culver City, from I-105 and SR-90 - 6 Lane Freeway, Add 2 HOV Lnaes and Soundwalls.	5			34,744,000	Same Project, RTIP State Project ID # 11985	-	Baseline		
LAX-24	Rosecrans/Aviation Intersection (Rosecrans from 4 to 6 Lanes, Aviation Blvd. From 6 to 9 Lanes) Bridge Widening & Lane Addition (C-I:44419)	-			5,762,000	Same Project, RTIP Project ID # LA000720	-	Tier 2		
LAX-25	Alameda Street from SR-1 to Henry Ford, Widen from 4 to 6 Lanes (CAT2 , CFP 2144).	0.75			4,967,000	Same Project, RTIP Project ID # LA000513	-	Baseline		

LAX S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
LAX-26	Sepulveda Blvd. From Centinela Asve. To lincoln Blv.d - Widen Sepulveda Blvd. Between LincolnBlvd. And Centinela to Provide Bus/Carpool Priority Lane.	Same as LAX -17								
LAX-27	Arbor Vitae Street from La Brea to I-405 Phase II Widening from 2 to 4 Lanes with a Left Turn Lane.	0.9			2,000,000	Same Project, RTIP Project ID # LA000170	-	Baseline		
TOTAL					1,234,678,333					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

MAR S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
MAFB-1	Construct connector road from Rte 215/Van Buren IC east to new March AFB passenger terminal (Divided major arterial configuration, 4 lanes in each direction, including turning lanes, emergency shoulder).	2 miles * 9	0.5*2	1,600,000	28,800,000	Similar Project ID # RIV991211	-----			
MAFB-2	Construct an internal airport roadway system including airport passenger and employee parking (3 lanes in each direction with double turning lanes).	2 miles *6	0.5*2	1,600,000	19,200,000	Similar Project ID # RIV991211	------			
MAFB-3	Construct internal air cargo terminal 6-lane roadway system including truck parking and ramp access facilitiesfor higher PCE truck traffic movements.	1.5 miles*6	0.5*2	1,600,000	14,400,000	Similar Project ID # RIV991211	------			
MAFB-4	Reconstruct the Rte 215/Van Buren IC (3 lane on-, and off-ramp configuration including wide turning lanes for high PCE truck traffic).	0.5miles*6			*7,763,000*	Similar Project, RTIP Project ID # 45300	3A01WT200	Plan Arterial Project	7,763,000	
MAFB-5	Widen ramps at I- 215/SR- 60 IC (add 1 lane to E/B SR- 60 to S/B I- 215 off-ramp) (add 1 lane to N/B Rte 215 to W/B SR- 60)	0.2miles*2			*5,800,000*	Similar Project, RTIP Project ID # 45300	3M04WT015& 16	Plan Projects	$5.8 M (Each at $2.9 M)	
MAFB-6	Construct major intersection at Imperial and Pershing with 3-lane turning lanes in each direction.	4.75 miles*2	1.7 miles*2	5,236,000	14,630,000	Similar Project, RTIP Local Project ID # RIV011208	-	Unconstrained		
MAFB-7	Construct Pershing to new West Terminal interchange to a major arterial standard with 3 lanes in each direction and dual turning lanes.	2 lanes*4 Approaches* 0.1 miles	1.7 miles*2	5,236,000	1,232,000	Similar Project, RTIP Local Project ID # RIV011208	-	Unconstrained		
MAFB-8	Upgrade I- 215/Cactus IC (additional turning lane from W/B Cactus to S/B I- 215)	0.2 miles *1			*2,900,000*	Similar Project, RTIP Project ID # 45300	3M04WT010	Plan Project	2,900,000	
MAFB-9	Construct connector between Rte 215/Oleander (Kuder) IC and new air cargo terminal at MAR AFB (major arterial, capable of higher PCE truck traffic, 3 lanes in each direction).	0.5 miles*6			*6,166,000*	Similar Project ID # RIV991211. Assumed the connector road to be approximately 0.5 miles.	3A04WT059	Plan Arterial Project	6,166,000	
MAFB-10	Add 2 lanes in each direction on Oleander (from I- 215 to Perris).	3.5 miles	2.25	7,433,000	11,562,444	Similar Project, RTIP Local Project ID # RIV62102. Three projects combined length 2.25 miles. Assumed addition of 2 lanes in each direction on the RTIP Project.	-	Unconstrained		

MAR S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
MAFB-11	Improve Oleander/Perris intersection (2 turning lanes in each direction)	2 lanes*4 Approaches* 0.1 miles	1.7 miles*2	5,236,000	1,232,000	Similar Project, RTIP Local Project ID # RIV011208	-	Unconstrained		
MAFB-12	Improve Cactus (add 1 lane in each direction from Rte 215/Cactus IC to Perris Bl.)	4.75 miles			*7,762,000*	Similar Project, RTIP Local Project ID # RIV011208	-	Unconstrained		
MAFB-13	Improve Alessandro (add 1 lane each direction from Day to Troutwein).	4.75 miles	1.7 miles	5,236,000	14,630,000	Similar Project, RTIP Local Project ID # RIV011208	3A01WT111	Very similar Plan Arterial Project	7,762,000	
MAFB-14	Improve Alessandro/Frontage intersection (2 turning lane configuration)	2 lanes*4 Approaches* 0.1 miles	1.7 miles*2	5,236,000	1,232,000	Similar Project, RTIP Local Project ID # RIV011208	-	Unconstrained		
MAFB-15	Improve Rte 60 (Caltrans: add 2 lanes from 215/60 IC to Redlands).	11.75 miles			39,954,000	Same Project, RTIP State Project ID # 46360	-	Baseline		
MAFB-16	Widen Perris Blvd. (1 added lane in each direction) from Cactus to Oleander	3.5 miles	2.25	7,433,000	11,562,444	Same Project, RTIP State Project ID # 46360	-	Unconstrained		
TOTAL					188,825,889					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

JWA S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
JWA-1	Improve capacity of JWA terminal internal circulation system. Upgrade JWA-ingress at Michelson/MacArthur intersection.	0.82	2.5	10,027,000	89,419,428	Similar Project, RTIP Local Project ID # ORA000169. Cost of adding 1 parking space in a parking structure is assumed to be about $25,000.	------			
JWA-2	Construct an internal MAGLEV station roadway system at the Irvine Spectrum (to accommodate 1,510 peak hour vehicle trips).	4	2.5	10,027,000	16,043,200	Similar Project, RTIP Local Project ID # ORA000169 (construction of 1 mile, 4-lane section)	-------			
JWA-3	Add 1 lane in each direction on MacArthur (from I-405 to Michelson).	0.8	2.5	10,027,000	3,208,640	Similar Project, RTIP Local Project ID # ORA000169	-	Unconstrained		
JWA-4	Add 1 lane in each direction on Michelson (from MacArthur to Von Karman).	0.45	2.5	10,027,000	1,804,860	Similar Project, RTIP Local Project ID # ORA000169	-	Unconstrained		
JWA-5	Add 1 lane in each direction on I-405 (from Bristol to SR-133); Add auxiliary lane (from MacArthur to Culver).	21.5			*112,651,731*	Similar Project, RTIP State Project ID # ORA020110	-	Unconstrained. **Please note the change in Total Cost**		
JWA-6	Upgrade the Bristol/I-405 IC (add 1 lane to all on and off-ramps)				86,243,000	Same Project, RTIP Project ID # 3090	2M01129	Similar Plan Project		40,000,000
JWA-7	Add 1 lane in each direction on SR 55 (from SR-73 IC to I-405 IC);	2.5	0.5	860,000	4,300,000	Similar Project, RTIP State Project ID # ORA000161	-	Unconstrained. Estimated Cost TBD		
JWA-8	Add S/B auxiliary lane (from MacArthur on-ramp to Jamboree Bl. IC to Culver Dr. off-ramp				12,903,000	Same Project, RTIP Project ID # ORA990603	-	Tier 2		
JWA-9	Add 1 lane in each direction on SR-73 (from Jamboree to SR 55); Add auxiliary N/B auxiliary lane to SR-73 (from Birch to SR 55)				17,488,000	Same Project (JWA-9 & JWA-14 Combined), RTIP Project ID # ORA55073	-	Baseline		

JWA S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
JWA-10	Upgrade the Sand Canyon/I-405 IC (add 1 lane to each on and off-ramp).				1,200,000	Same Project, RTIP Project ID # ORA010201	-	Baseline		
JWA-11	Add 1 lane to the southbound off-ramp and the north-bound on-ramp at Irvine Center Dr./I-405 IC	2			*1,300,000*	Similar Project, RTIP State Project ID # 020108	2M04130	Plan Project	1,300,000	
JWA-12	Add 1 N/B ramp and W/B right-turn lane on Paularino at SR 55.				438,000	Same Project, RTIP Project ID # ORA016	-	Tier 2		
JWA-13	Widen Von Karman overcrossing by 1 lane in each direction.				6,951,000	Same Project, RTIP Project ID # ORA55105	-	Baseline		
JWA-14	Add HOV lanes in each direction near SR 55 IC (98 STIP)					----------------------- See JWA-9 -------- ---------------------	-	Baseline		
JWA-15	I-405/SR 55 IC south Transitway existing 4 MF 1 HOV on SR 55 and I-405 existing 5 MF and 1 HOV, add HOV direct Transitway from SR 55 to I-405.				16,462,000	Same Project, RTIP State Project ID # 6951	-	Baseline		
JWA-16	SJHC, 15 mile Toll Road I-5 (in San Juan Capistrano and SR- 73 in Irvine, existing 3 MF each direction, add 1 MF in each direction, plus auxiliary and PCE traffic climbing lanes (reference: SCAG/TCA MOU 4/5/01).				113,594,000	Same Project, RTIP State Project ID # 10254	-	Tier 2		
TOTAL					484,006,859					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

ONT S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
ONT-1	Upgrade ONT internal circulation system to accommodate 30 MAP, curbside, parking ingress/egress inclusive.	1*5280	1450	1,976,000	274,788,466	Similar Project, RTIP local Project ID # SBI59006. Assumed an addition of 17684 parking lot to accommodate 30MAP. (deducted existing 13,758 spaces from the total provided by Dr. Andrew 31,442). Assumed 2-lane widening of total 1 mile of roadway section including terminal frontage and the frontage road at the old terminal building.	------			
ONT-2	Construct an internal MAGLEV station roadway system of 4 lanes in each direction (to accommodate 2,341 peak hour vehicle trips).	4*5280	1450'	1,976,000	28,781,462	Similar Project, RTIP Local Project ID # SBI59006 (construction of 1 mile, 4-lane section)	-------			
ONT-3	Add 2 lanes in each direction plus turning lanes on Archibald (from south of Guasti to I-10 IC).	0.5*5280*4			*21,068,000*	Similar Project, RTIP Local Project ID # SBI59006	4G0116	Planned Grade Crossing Projects	21,068,000	
ONT-4	Add 2 lanes in each direction on Airport from (from Archibald to Haven).	2*1.05*5280'			*24,000,000*	Similar Project, RTIP Local Project ID # SBI59006	4A01186	Similar Plan Arterial Project	24,000,000	
ONT-5	Add 2 lanes to on-, off-ramps at I-10/Archibald IC.	4	1	1,875,000	7,500,000	Similar Project, RTIP State Project ID # 2002163	-	Unconstrained		
ONT-6	Add 2 lanes in each direction on I-10 (from I-15 IC to Euclid).	10.25*4	2.2*2	13,132,000	122,366,364	Similar Project, RTIP State Project ID # LA01342. No similar projects on 10 in San Bernardina or Riverside counties.	4H01001	Similar Plan Project from I-15 to SR38	350,000,000	
ONT-7	Add 2 lanes in each direction on SR- 60 (from I-15 to Euclid).	9.25	11.3	72,250,000	59,142,699	Similar Project, Similar LA996137 (SR-60 HOV Lanes in LA County)	-	Unconstrained		
ONT-8	Widen Holt by 2 lanes in each direction (from I-10 ramps to Grove).	3000			*7,152,000*	Similar Project, RTIP Local Project ID # SBI59006	4A01210	Similar Arterial Plan Project	7,152,000	
ONT-9	Widen Vineyard by 2 lanes in each direction (from Airport to I-10 IC).	0.75*5280*4	4800'	4,800,000	15,840,000	Similar Project, RTIP Project ID # SBI59009	-	Unconstrained		
ONT-10	Widen Grove by 1 lane in each direction, including turning lanes, (from I-10 to SR- 60). UCT railroad grade separation widening on Grove (from Belmont to Airport).				23,596,000	Same Projects, RTIP Project Ids 2002161, SBI 031314, SBI41301, SBI59006, SBI94171	-	Baseline and Tier 2 Projects		

ONT S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
ONT-11	Add W/B and E/B off-ramps on I-10 at Grove. Configure all ramps to 3-lane configuration.				16,500,000	Same Project, RTIP Project ID 2002160	-	Tier 2		
ONT-12	Widen Haven by 2 lanes in each direction (from SR-60 to Foothill).	7*5280*4			*20,000,000*	Similar Project, RTIP Project ID # SBI59009	4A01209	Similar Plan Arterial Project	20,000,000	
ONT-13	Add 1 lane in each direction on Mission (from Euclid to Haven). Upgrade Mission/Grove intersection for high PCE truck traffic.				9,600,000	Same Project, RTIP Project ID # SBI031315	-	Tier 2		
ONT-14	Reconfigure and upgrade I-10/Milliken IC for High PCE truck traffic; add 1 lane to each ramps, reduced-angle turning movements; add 1 lane in each direction on Milliken (from I-10 and Airport).	0.3			8,577,143	Similar Project, RTIP Project ID #'s 2002163 & 200030	-	Unconstrained		
ONT-15	Add 1 lane in each direction on I-15 (from SR- 60 to I-10).	8	28.6	54,106,000	15,134,545	Similar Project, RTIP Project ID # 35557	3M01MA06	Similar Plan Project, from San Diego County line to SR 60	359,000,000	
ONT-16	Add 1 lane in each direction on Philadelphia (from Campus to Grove and from Vineyard to Rancho Cucamonga Creek, bridge upgrade inclusive).				2,600,000	Same Projects, RTIP Project ID #'s 2002162 & SBI59002	-	Tier 2		
TOTAL					656,646,679					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

PSP S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
PSP-1	Upgrade internal PSP terminal area circulation system including parking facilities (to accommodate 3.2 MAP). Upgrade terminal area ingress/egress from Tahquitz Canyon	1	2	3,324,000	100,644,600	Similar Project, Local Project ID # RIV011203 (upgrading 2 intersections based on PSP-3, and addition of 4,884 space parking surface lot, Includes upgrading 1 mile of roadway section by adding 2 lanes)	------			
PSP-2	Add 1 lane in each direction on Ramon Rd (from Sunrise to El Cielo) to a continuous 4-lane major arterial configuration.	0.76 miles			1,871,000	Same Project, RTIP Local Project ID # RIV32596	-	Baseline		
PSP-3	Upgrade El Cielo/Ramon Rd. intersection for higher PCE air cargo truck traffic.	4* 0.3 miles	2	3,324,000	1,994,400	Similar Project, RTIP Local Project ID # RIV011203. Asssumed approximately 0.3 miles of widening on each approach.	-	Unconstrained		
PSP-4	Add 1 lane in each direction on Farrell (from Ramon Rd. to Vista Chino)	2.03 miles	2	3,324,000	3,373,860	Similar Project, RTIP Local Project ID # RIV011203.	-	Unconstrained		
PSP-5	Upgrade intersection of Indian Canyon and Tahquitz Canyon Rd	4* 0.3 miles	2	3,324,000	1,994,400	Similar RTIP Local Project ID # RIV011203. Asssumed approximately 0.3 miles of widening on each approach.	-	Unconstrained		
PSP-6	Upgrade 1-10/Date Palm IC ramps to a 2-lane configuration.				16,750,000	Same Project, RTIP State Project ID # 45590	-	Tier 2		
PSP-7	Add 1 additional left and right turning lanes from Tahquitz to Palm Canyon.	0.3 miles	2	3,324,000	498,600	Similar Project, RTIP Local Project ID # RIV011203. Asssumed approximately 0.3 miles of total turn lanes on one approach only on Tahquitz.	-	Unconstrained		
PSP-8	Upgrade 1-10/Gene Autry Trail IC ramps to a 2-lane configuration.				17,690,000	Same Project, RTIP State Project ID # 45580	-	Tier 2		
PSP-9	Modify Gene Autry Trail from 2 to 6 lanes (from 1-10 IC to Salvia Rd.)	INCLUDED IN PSP-8					-	Unconstrained		
PSP-10	Modify Gene Autry Trail from Salvia Rd. to Vista Chino to a 6-lane configuration.	2.25 miles*4	2*2	3,324,000	7,479,000	Similar Project, RTIP Local Project ID # RIV011203. Assumed addition of 4 lanes	-	Unconstrained		
PSP-11	Construct bridges on Gene Autry Trail at the railroad crossing and at Whitewater River.	2 bridges			38,722,000	Same Project, RTIP Local Project ID # RIV62000. This Project says that the bridges alreaddy exist. Just widening is needed on GAT including the bridges.	-	Tier 2		
PSP-12	Widen Indian Canyon Drive to a 6-lane configuration (from Union Pacific Rail Road to 1-10).				2,423,000	Same RTIP Local Project ID's # RIV990727. Including PSP-11	-	Tier 2		
TOTAL					193,440,860					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

LGB S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
LGB-1	Widen Lakewood by 1 lane in each direction (from I-405 to Carson)	1.75*2			*12,000,000*	Similar Project, RTIP Local Project ID # LA960150. Assumed 1 lane in each direction	1A98GC07	Similar Arterial Plan Project	12,000,000	
LGB-2	Upgrade capacity of lakewood/ Wardlow intersection.	N/A			717,000	Similar Project, RTIP Local Project ID # LA0C8009 (in Torrance)	-	Unconstrained		
LGB-3	Upgrade ramps at I- 405 IC/lakewood IC (Add 1 lane to the S/B lakewood to N/B .I-405 on-ramp; Add 1 lane to S/B I- 405 to Lakewood Off-ramp.	N/A			5,264,000	Similar Project, RTIP Local Project ID # LA996369	-	Unconstrained		
LGB-4	Widen Wardlow by 1 lane in each direction (from lakewood to Bellflower)	0.75*2	0.25*2	850,000	2,550,000	Similar Project, RTIP Local Project ID # LA960150. Assumed 1 lane in each direction	-	Unconstrained		
LGB-5	Upgrade Spring Street to 4 lanes (from Orange to Cherry); Upgrade Spring/Lakewood intersection.	0.5*2	0.25*2	850,000	1,700,000	Similar Project, RTIP Local Project ID # LA960150. Assumed 1 lane in each direction	-	Unconstrained		
LGB-6	Capacity improvements to I- 405 including HOV lanes (see LAX Projects)	N/A			6,237,000	Similar Project, State Project ID # LA0C8344	-	Unconstrained		
TOTAL					28,468,000					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

SBI S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
SBI-1	Upgrade internal circulation system to the SBI passenger terminal at Leland Norton Way and Rialto. Construct 6-lane major arterial configuration with double turning lanes and emergency lanes.	2*6+0.7*4	1	530,000	308,804,500	Similar Project, RTIP Project ID # SBI031357. Includes addition of 0.7 miles of Aux. 4lane divide roadway and addition of 15,635 parking space surface lot at $19,500 per space.	------			
SBI-2	Construct a truck traffic access road (4-lane major arterial configuration with shoulder) to the SBI Air Cargo Terminal at Perimeter Road. Upgrade Perimeter Road-3rd Street/Leland Norton Way for high PCE truck traffic.	1	0.5	850,000	1,700,000	Similar Project, RTIP Local Project ID # SBI59016	-------			
SBI-3	Add 2 lanes in each direction on Waterman (from 9th Street to Rialto and from Vanderbilt to the I-10 IC).	1.35*4	0.8*2	1,740,000	5,872,500	Similar Project, RTIP Local Project ID # SBI55032	-	Unconstrained		
SBI-4	Upgrade Rialto to a continuous, divided 6-lane configuration (from Waterman to I- 215)	1.3	1	530,000	689,000	Similar Project, RTIP Project ID # SBI031357. Assumed addition of 1 lanes in each direction.	-	Unconstrained		
SBI-5	Upgrade the I-10/Waterman IC (add 1 additional on-, and off-ramp in each direction designed for higher PCE truck traffic).				16,500,000	Similar Project, RTIP Local Project ID # 2002160	-	Unconstrained		
SBI-6	Add 2 lanes in each direction on 3rd Street (from Waterman to Alabama/Palm) to a 6-lane configuration; Construct diagonal 6-lane connection form 3rd Street to 5th Street east of Alabama.	4.27+0.25 miles	0.8*2	1,740,000	19,401,463	Similar Project, RTIP Local Projects ID # SBI55032 and same project ID # 200213 for the 3rd street diagonal connector	-	Tier 2. (only the 3rd to 5th Connector project) rest of the description Unconstrained.		
SBI-7	Upgrade 5th Street to a 6-lane major arterial configuration with turning lanes and improved capacity intersections at 3rd Street diagonal connector, Palm, Waterman, and La Rosa.	4.25 miles* 4	0.8*2	1,740,000	18,487,500	Similar Project, RTIP Local Project ID # SBI55032	-	Unconstrained		
SBI-8	Upgrade Harry Sheppard Bl. (from Leland Norton Way to Tippecanoe).	0.6 miles *4	0.8*2	1,740,000	2,610,000	Similar Project, RTIP Local Project ID # SBI55032	-	Unconstrained		
SBI-9	Upgrade the I- 215/Mill IC (add 1 lane to each on-, and off-ramp designed for higher PCE truck traffic).				16,500,000	Similar Project, RTIP Local Project ID # 2002160	-	Unconstrained		
TOTAL					390,564,963					

Phase 1

(cyan)	Baseline
(blue)	Tier 2
(blue)	Plan

Phase 2

(yellow)	Beyond the

Plan

SCL S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
SCL-1	Construct airport terminal connector road from Air Base to terminal building (along Cory to Phantom); Construct connector road from Air Base to air cargo terminal in the southwest corner of the base.	1.33+1.6 miles	0.5*2	300,000	145,955,850	Similar Project, RTIP ID # SBI31727. Per Dr. Andrew, considered a total of 2.93 miles of additional 6-lane section roadway . Also assumed the cost for one surface parking space to be $19,450 (including land)	------			
SCL-2	Improve and upgrade existing internal circulation system (Cory from Air base to Phantom; Cory segment from Starfighter to Sabre; intersection Worley/Phantom) including access to on-site MAGLEV terminal.		0.5*2	300,000	0	Similar Project, RTIP ID # SBI31727. Assumed Cory segments total to be 1 mile addition of 1 lane in each dir. Assumed MAGLEV access road to be a new 1 mile 6-lane section	------			
SCL-3	MAGLEV station internal access road system should have a capacity of 3 lanes in each direction (to accommodate 836 peak hour passenger vehicle trips).	Included in SCL-2					------			
SCL-4	Widen Air Base (add 2 lanes in each direction from US 395 to National Trails intersection)	5 miles*4	0.5*2	300,000	6,000,000	Similar Project, RTIP ID # SBI31727		Tier 2. Very similar project. Also Plan Arterial Project ID 4A01303 $3.13M Public Funding)		
SCL-5	Add 2 lanes to southbound on-ramps and northbound off-ramps at I-15/National Trails IC. Add 1 additional lane to southbound off-ramps and northbound on-ramps at I-15/National Trails IC.	2-2LN ramps	1 -2LN ramp	1,000,000	2,000,000	Similar Project, RTIP Project ID # SBI41288. Description not clear. Assumed 2 lanes each on NB and SB Ramps		Unconstrained		
SCL-6	Add 2 additional turning lanes in each direction on National Trails at I-15.				*1,207,000*	Similar Project, RTIP Local Project ID # SBI88140 Assumed the same length	4A01339	Similar Plan Arterial Project	1,207,000	
SCL-7	Improve National Trails/Air Base intersection in conjunction with National Trails/Rancho intersection (part of Construction of Rancho extension project from Adelanto to National Trails)				655,000	Similar Project, RTIP Local Project ID # 980105	4A01362	Plan Arterial Project (Rancho Ext.)	$5,391,000 (more than intersection)	

SCL S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
SCL-8	Add 1 lane in each direction to National Trains from I-15 to Barstow.	30.16 miles	2	1,200,000	18,096,000	Similar Project, RTIP Project ID # SBI88140		Unconstrained		
SCL-9	Widen National Trails/RR underpass (approx. 3.49 mi north of Air Base) to 2 lanes in each direction.				1,200,000	Same Project, RTIP Project ID # SBI88140	-	Baseline		
SCL-10	Add N/B mixed flow lane w. aux lane (from N/) Mojave Dr. IC to Stoddard Wells Rd.				55,705,000	Same Project, RTIP State Project ID # 35556	-	Tier 2		
SCL-11	Construct 6 lane freeway (at I-15/SR395) JCT t0 S/O Framington Rd.) from SR 18 to Purple Sage plus 4lane expressway from Purple Sage to Framington				14,000,000	Same Project, RTIP Project ID # 34040	-	Tier 2		
SCL-12	Widen El Evado Rd, Palmdale Rd to Air Base Rd., Palmdale to Hopland, Hopland to Air Base (from 2 to 4 lanes with LT lanes)				4,000,000	Same Project, RTIP Project ID # SBI031419	-	Tier 2		
TOTAL					248,818,850					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

PMD S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
PMD-1	Construct airport terminal connector road from Ave P to the new PMD passenger terminal	1.62miles of 8ln roadway section	6.5	4,000,000	3,987,692	Similar Project, RTIP Project ID LA962212.	-----			
PMD-2	Construct internal airport circulation system based on an 8-lane configuration (with shoulders and emergency lanes) including internal parking facilities (12.78 MAP).	0.62 miles of 8ln. roadway and 25,556 Pkg. Spaces	6.5	4,000,000	498,590,354	Similar Project, RTIP Project ID LA962212. Assumed being widened from 2 to 4 lanes as Ave. P-8. Assumed cost of 1 parking space on surface parking lot to be $19,450. (Deducted 300 existing spaces)	-----			
PMD-3	Widen Ave P to 4 lanes in each direction including turning lanes (from SR- 14 to 50th St east of PMD). Configure Ave P as a major arterial capable of high PCE truck traffic.	6.5	6.5	4,000,000	4,000,000	Similar Project, RTIP Project ID LA962212. Assumed being widened from 2 to 4 lanes as Ave. P-8.		Unconstrained		
PMD-4	Add on-ramps from W/B Ave P to N/B Rte 14 (2-lane on-ramps with shoulder) capable of carrying higher PCE truck traffic.				*1,000,000*	Similar Project, RTIP State Project ID # LA9811103	1M0445	Plan Arterial Project. (Does not provide any description)	1,000,000	
PMD-5	Add S/B off-ramp from Rte 14 to Ave P (2-lane off-ramp with shoulder) capable of higher PCE truck traffic.				2,500,000	Similar Project, RTIP State Project ID # LA9811103	Could be part of 1M0445 above.			
PMD-6	Improve Ave P intersection capacity at 20th St., 30th St, Sierra and 50th Ave by adding two turning lanes in each direction.	2*4*4*0.1	10*2	16,175,000	2,588,000	Similar Project, RTIP Project ID # LA9910006. Assumed 2 lanes 0.1 miles per approach at 4 approaches and 4 intersections.		Unconstrained		
PMD-7	Construct a high capacity intersection at P Ave and 25th St. with 3 lanes in each direction, dual turning lanes, and shoulders.	0.025*4*6	1*2	1,469,000	440,700	Similar Project, RTIP Project ID # LA960122		Unconstrained		
PMD-8	Add 1 lane in each direction on Sierra (between Palmdale Blvd. and Ave M.	4.75*2			*27,000,000*	Similar Project, RTIP Project ID # LA9811094	1A98NLA28	Similar Arterial Plan Project	27,000,000	
PMD-9	Add 1 lane in each direction on Ave M including turning lanes (from Rte 14 to 50th St)	6miles * 2	10*2	16,175,000	9,705,000	Similar Project, RTIP Project ID # LA9910006	-	Unconstrained		

PMD S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
PMD-10	Widen 50th St. by 2 lanes in each direction (from Ave M to Ave R); improve 50th St/R Ave intersection capacity.	5.1miles*4	10*2	16,175,000	16,498,500	Similar Project, RTIP Project ID # LA9910006	-	Unconstrained		
PMD-11	Widen 30th Street (from Palmdale Bl. to Ave P) including 2-lane turning lanes at P Ave.	1.5 miles * 4	1	200,000	1,200,000	Similar Project, RTIP Project ID # LA960104	-	Unconstrained.		
PMD-12	Add 2 lanes in each direction on SR- 14 from Pearblossom Hwy to Ave M including HOV lanes (heavy directional AM/PM traffic volumes hampering peak period airport access from LA Basin)	11*4	2 * 7	38,635,000	121,424,286	Similar Project, RTIP Project ID # LA01347	-	Unconstrained. Very Similar Tier 2 Project (LA01347).		
TOTAL					688,934,532					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

BUR S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
BUR-1	Upgrade internal BUR terminal area circulation system including ingress/egress to parking facilities.	0.5 miles	2	39,919,000	9,979,750	Similar Project, RTIP Project ID # LA000443. Assumed approx. 0.5 miles of roadway upgrade by adding an additional lane. No Parking upgrades	-----			
BUR-2	Upgrade capacity of Hollywood/Thornton intersection (2 additional turning lanes and increased turn lane storage capacity)	4	1	232,000	928,000	Similar Project, RTIP Project ID # LA0C8053. (Assumed 2 lanes on all 4 approaches)	-	Unconstrained		
BUR-3	Add 1 additional lane in each direction on Hollywood Bl. (from San Fernando to Jct. of Hollywood/Edison); Upgrade capacity of Hollywood/Edison Intersection (additional turning lanes and increased turn lane storage).	2	2	39,919,000	39,919,000	Similar Project, RTIP Project ID # LA000443	-	Unconstrained		
BUR-4	Upgrade capacity of Hollywood/Alameda intersection (additional turning lanes and storage).	4	1	232,000	928,000	Similar Project, RTIP Project ID # LA0C8053	-	Unconstrained		
BUR-5	Upgrade Whitnall Pass/Alameda intersection (additional turning lanes).	4	1	232,000	928,000	Similar Project, RTIP Project ID # LA0C8053	-	Unconstrained		
BUR-6	Add interchange ramps at Buena Vista and I-5 IC.				*14,000,000*	Similar Project, RTIP State Project ID # LA996375. Assumed to be complete with auxiliary lanes as the Empire Ave. IC	1M0127	Plan Arterial Project	14,000,000	
BUR-7	Construct a modified interchange at Empire Ave and I-5 IC. Add N/B and S/B (auxiliary) lanes at I-5/Empire (from Burbank Bl. To Empire)				48,682,000	Same Project, RTIP State Project ID # LA996375	-	Baseline		
BUR-8	Add auxiliary lanes on I-5 (from Burbank Bl. To Buena Vista)	1.5	9	48,682,000	8,113,667	Similar RTIP State Project ID # LA996375	-	Unconstrained. Estimated Cost 47,000,000	Est. is longer distance.	
BUR-9	Add HOV lanes (from 8-10 lane configuration) on I-5 (from SR- 134 to SR- 170)				52,502,000	Same Project, RTIP State Project ID # LA000358	-	Baseline		
BUR-10	Vanowen St. bridge widening and rehab project.				7,717,000	Same Project, RTIP Local Project ID # LA0C8042	-	Baseline		

BUR S.No	Project Description	Unit Length (Subject Project)	Unit Length (from Source Project)	Cost (from Source Project)	Total Cost (Subject Project)	Source/Remarks	RTP ID	Category	Public Funding	Private Funding
BUR-11	Construct HOV lanes on I-5 (between SR110 and SR14)	27	9	52,502,000	157,506,000	Similar RTIP State Project ID # LA000358	-	Unconstrained		
BUR-12	Burbank Transit Station project.				*10,000,000*	Similar RTIP Transit Project ID # LA974181	-	Unconstrained. Estimated Cost **$506,000,000**	Est. reduced for this anaylsis.	
TOTAL					351,203,417					

Phase 1

Baseline

Tier 2

Plan

Phase 2

Beyond the Plan

Attachment B – Cost Estimate Summary by Airport

LAX

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
LAX																
	1														127,867,500	
	2														20,404,000	
	3														127,867,500	
	4			10,202,000												
	5														0	
	6														2,019,000	
	7														0	
	8														312,565,000	
	9														800,000	
	10		13,984,000													
	11															2,000,000
	12		6,000,000													
	13														4,334,000	
	14															2,000,000
	15														4,000,000	
	16			52,127,000												
	17		2,662,000													
	18		19,260,500													
	19		4,752,000													
	20		6,153,000													
	21					7,458,000										
	22		5,935,000													

LAX

AIRPORT	Project Number	RTP - Phase 1												Phase 2 (Beyond RTP)		
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
		Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	23			34,744,000												
	24		5,762,000													
	25		4,967,000													
	26		0													
	27		2,000,000													
		0	71,475,500	97,073,000	0	7,458,000	0	0	0	0	0	0	0	0	599,857,000	4,000,000

All Internal Circ., Transit & Parking	0
All Arterials	78,933,500
All Freeway & Interchanges	97,073,000

All Baseline Projects	168,548,500
All Tier 2 Projects	7,458,000
All Plan Projects	0
All Unconstrained Projects	0
All Additional Projects (beyond the RTP)	603,857,000

TOTAL All Projects	779,863,500

March

AIRPORT	Project Number	RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
		Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													28,800,000		
	2													19,200,000		
	3													14,400,000		
	4									7,763,000						
	5									5,800,000						
	6														14,630,000	
	7														1,232,000	
	8									2,900,000						
	9								6,166,000							
	10														11,562,444	
	11														1,232,000	
	12														7,762,000	
	13								14,630,000							
	14														1,232,000	
	15			39,954,000												
	16			11,562,444												
		0	0	51,516,444	0	0	0	0	20,796,000	16,463,000	0	0	0	62,400,000	37,650,444	0

All Internal Circ., Transit & Parking	0
All Arterials	20,796,000
All Freeway & Interchanges	67,979,444

All Baseline Projects	51,516,444

March

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges

All Tier 2 Projects	0
All Plan Projects	37,259,000
All Unconstrained Projects	0
All Additional Projects (beyond the RTP)	100,050,444

TOTAL All Projects	188,825,889

JWA

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			**Ties 2**			**Plan**			**Unconstrained**			**Additional Projects**		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													89,419,428		
	2													16,043,200		
	3														3,208,640	
	4														1,804,860	
	5															112,651,731
	6									86,243,000						
	7												4,300,000			
	8						12,903,000									
	9			17,488,000												
	10			1,200,000												
	11									1,300,000						
	12						438,000									
	13		6,951,000													
	14			0												
	15			16,462,000												
	16						113,594,000									
		0	6,951,000	35,150,000	0	0	126,935,000	0	0	87,543,000	0	0	4,300,000	105,462,628	5,013,500	112,651,731

All Internal Circ., Transit & Parking			0
All Arterials			6,951,000
All Freeway & Interchanges			253,928,000

JWA

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			**Ties 2**			**Plan**			**Unconstrained**			**Additional Projects**		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	All Baseline Projects				42,101,000											
	All Tier 2 Projects				126,935,000											
	All Plan Projects				87,543,000											
	All Unconstrained Projects				4,300,000											
	All Additional Projects (beyond the RTP)				223,127,859											
	TOTAL All Projects					484,006,859										

ONT

AIRPORT	Project Number	RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
		Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													274,788,466		
	2													28,781,462		
	3								21,068,000							
	4								24,000,000							
	5														7,500,000	
	6									122,366,364						
	7															59,142,699
	8								7,152,000							
	9														15,840,000	
	10		11,798,000			11,798,000										
	11					16,500,000										
	12									20,000,000						
	13					9,600,000										
	14															8,577,143
	15									15,134,545						
	16					2,600,000										
		0	11,798,000	0	0	40,498,000	0	0	52,220,000	157,500,909	0	0	0	303,569,928	23,340,000	67,719,842

All Internal Circ., Transit & Parking			0
All Arterials			104,516,000
All Freeway & Interchanges			157,500,909

ONT

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			**Ties 2**			**Plan**			**Unconstrained**			**Additional Projects**		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges

All Baseline Projects	11,798,000
All Tier 2 Projects	40,498,000
All Plan Projects	209,720,909
All Unconstrained Projects	0
All Additional Projects (beyond the RTP)	394,629,770

TOTAL All Projects	656,646,679

PSP

AIRPORT	Project Number	RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
		Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													100,644,600		
	2		1,871,000													
	3														1,994,400	
	4														3,373,860	
	5														1,994,400	
	6						16,750,000									
	7														498,600	
	8						17,690,000									
	9														0	
	10														7,479,000	
	11					38,722,000										
	12					2,423,000										
		0	1,871,000	0	0	41,145,000	34,440,000	0	0	0	0	0	0	100,644,600	15,340,260	0

All Internal Circ., Transit & Parking	0
All Arterials	43,016,000
All Freeway & Interchanges	34,440,000

All Baseline Projects	1,871,000
All Tier 2 Projects	75,585,000

All Plan Projects	0	
All Unconstrained Projects	0	
All Additional Projects (beyond the RTP)	115,984,860	
TOTAL All Projects		193,440,860

LGB

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1								12,000,000							
	2														717,000	
	3															5,264,000
	4														2,550,000	
	5														1,700,000	
	6															6,237,000
		0	0	0	0	0	0	0	12,000,000	0	0	0	0	0	4,967,000	11,501,000

All Internal Circ., Transit & Parking			0
All Arterials			12,000,000
All Freeway & Interchanges			0

All Baseline Projects	0
All Tier 2 Projects	0
All Plan Projects	12,000,000
All Unconstrained Projects	0
All Additional Projects (beyond the RTP)	16,468,000

TOTAL All Projects	28,468,000

SBI

AIRPORT	Project Number	RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
		Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													308,804,500		
	2													1,700,000		
	3														5,872,500	
	4														689,000	
	5															16,500,000
	6					19,401,463										
	7														18,487,500	
	8														2,610,000	
	9									-			-			16,500,000
		0	0	0	0	19,401,463	0	0	0	0	0	0	0	310,504,500	27,659,000	33,000,000

All Internal Circ., Transit & Parking			0
All Arterials			19,401,463
All Freeway & Interchanges			0

All Baseline Projects	0
All Tier 2 Projects	19,401,463
All Plan Projects	0
All Unconstrained Projects	0
All Additional Projects (beyond the RTP)	371,163,500

TOTAL All Projects	390,564,963

SCL

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													145,955,850		
	2													0		
	3													0		
	4					6,000,000										
	5															2,000,000
	6									1,207,000						
	7								655,000							
	8															18,096,000
	9		1,200,000													
	10						55,705,000									
	11						14,000,000									
	12					4,000,000										
		0	1,200,000	0	0	10,000,000	69,705,000	0	655,000	1,207,000	0	0	0	145,955,850	0	20,096,000

All Internal Circ., Transit & Parking	0
All Arterials	11,855,000
All Freeway & Interchanges	70,912,000

All Baseline Projects	1,200,000
All Tier 2 Projects	79,705,000
All Plan Projects	1,862,000

All Unconstrained Projects	0	
All Additional Projects (beyond the RTP)	166,051,850	
TOTAL All Projects		248,818,850

PMD

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													3,987,692		
	2													498,590,354		
	3														4,000,000	
	4								1,000,000							
	5									2,500,000						
	6														2,588,000	
	7														440,700	
	8								27,000,000							
	9														9,705,000	
	10														16,498,500	
	11														1,200,000	
	12						121,424,286			-			-			-
		0	0	0	0	0	121,424,286	0	28,000,000	2,500,000	0	0	0	502,578,046	34,432,200	0

All Internal Circ., Transit & Parking			0
All Arterials			28,000,000
All Freeway & Interchanges			123,924,286

All Baseline Projects	0
All Tier 2 Projects	121,424,286

All Plan Projects	30,500,000
All Unconstrained Projects	0
All Additional Projects (beyond the RTP)	537,010,246
TOTAL All Projects	688,934,532

BUR

		RTP - Phase 1									Phase 2 (Beyond RTP)					
		Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
AIRPORT	Project Number	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
	1													9,979,750		
	2														928,000	
	3														39,919,000	
	4														928,000	
	5														928,000	
	6									14,000,000						
	7			48,682,000												
	8												8,113,667			
	9			52,502,000												
	10		7,717,000													
	11															157,506,000
	12													10,000,000		
		0	7,717,000	101,184,000	0	0	0	0	0	14,000,000	0	0	8,113,667	19,979,750	42,703,000	157,506,000

All Internal Circ., Transit & Parking	0
All Arterials	7,717,000
All Freeway & Interchanges	123,297,667

All Baseline Projects	108,901,000
All Tier 2 Projects	0

All Plan Projects	14,000,000	
All Unconstrained Projects	8,113,667	
All Additional Projects (beyond the RTP)	220,188,750	
TOTAL All Projects		351,203,417

All 10 Airports

	RTP - Phase 1									Phase 2 (Beyond RTP)					
	Baseline			Ties 2			Plan			Unconstrained			Additional Projects		
	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges
TOTAL (10 Airports)	0	101,012,500	284,923,444	0	118,502,463	352,504,286	0	113,671,000	279,213,909	0	0	12,413,667	1,551,095,302	790,962,404	406,474,573

All Internal Circ., Transit & Parking	1,551,095,302	38.7%
All Arterials	1,124,148,368	28.0%
All Freeway & Interchanges	1,335,529,879	33.3%

All Baseline Projects	385,935,944
All Tier 2 Projects	471,006,749
All Plan Projects	392,884,909
All Unconstrained Projects	12,413,667
All Additional Projects (beyond the RTP)	2,748,532,279

RTP Projects - Phase 1	1,249,827,603	31.16%
Phase 2	2,760,945,946	68.84%

TOTAL All Projects	4,010,773,549

All 10 Airports

	RTP - Phase 1									Phase 2 (Beyond RTP)						
	Baseline			Ties 2			Plan			Unconstrained			Additional Projects			
AIRPORT	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	Internal Circulation, Transit and Parking	Arterials	Freeways & Interchanges	TOTAL
LAX	0	71,475,500	97,073,000	0	7,458,000	0	0	0	0	0	0	0	0	599,857,000	4,000,000	779,863,500
March	0	0	51,516,444	0	0	0	0	20,796,000	16,463,000	0	0	0	62,400,000	37,650,444	0	188,825,889
JWA	0	6,951,000	35,150,000	0	0	126,935,000	0	0	87,543,000	0	0	4,300,000	105,462,628	5,013,500	112,651,731	484,006,859
ONT	0	11,798,000	0	0	40,498,000	0	0	52,220,000	157,500,909	0	0	0	303,569,928	23,340,000	67,719,842	656,646,679
PSP	0	1,871,000	0	0	41,145,000	34,440,000	0	0	0	0	0	0	100,644,600	15,340,260	0	193,440,860
LGB	0	0	0	0	0	0	0	12,000,000	0	0	0	0	0	4,967,000	11,501,000	28,468,000
SBI	0	0	0	0	19,401,463	0	0	0	0	0	0	0	310,504,500	27,659,000	33,000,000	390,564,963
SCL	0	1,200,000	0	0	10,000,000	69,705,000	0	655,000	1,207,000	0	0	0	145,955,850	0	20,096,000	248,818,850
PMD	0	0	0	0	0	121,424,286	0	28,000,000	2,500,000	0	0	0	502,578,046	34,432,200	0	688,934,532
BUR	0	7,717,000	101,184,000	0	0	0	0	0	14,000,000	0	0	8,113,667	19,979,750	42,703,000	157,506,000	351,203,417
TOTAL	0	101,012,500	284,923,444	0	118,502,463	352,504,286	0	113,671,000	279,213,909	0	0	12,413,667	1,551,095,302	790,962,404	406,474,573	4,010,773,549